



BILLING CODE 3510-22-P

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

RIN: 0648-XF286

Takes of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals Incidental to Site Characterization Surveys off the Coast of New Jersey

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Notice; proposed incidental harassment authorization; request for comments.

SUMMARY: NMFS has received an application from Ocean Wind, LLC (Ocean Wind), for an Incidental Harassment Authorization (IHA) to take marine mammals, by harassment, incidental to high-resolution geophysical (HRG) and geotechnical survey investigations associated with marine site characterization activities off the coast of New Jersey in the area of the Commercial Lease of Submerged Lands for Renewable Energy Development on the Outer Continental Shelf (OCS-A 0498) (Lease Area). Pursuant to the Marine Mammal Protection Act (MMPA), NMFS is requesting comments on its proposal to issue an IHA to Ocean Wind to incidentally take marine mammals during the specified activities.

DATES: Comments and information must be received no later than *[insert date 30 days after date of publication in the **FEDERAL REGISTER**]*.

ADDRESSES: Comments on Ocean Wind's IHA application should be addressed to Jolie Harrison, Chief, Permits and Conservation Division, Office of Protected Resources, National Marine Fisheries Service, 1315 East-West Highway, Silver Spring, MD 20910. The mailbox address for providing email comments is *itp.mccue@noaa.gov*.

Instructions: NMFS is not responsible for comments sent by any other method, to any other address or individual, or received after the end of the comment period. Comments received electronically, including all attachments, must not exceed a 25-megabyte file size. Attachments to electronic comments will be accepted in Microsoft Word or Excel or Adobe PDF file formats only. All comments received are a part of the public record and will generally be posted to the Internet at www.nmfs.noaa.gov/pr/permits/incidental/energy_other.htm without change. All personal identifying information (*e.g.*, name, address) voluntarily submitted by the commenter may be publicly accessible. Do not submit confidential business information or otherwise sensitive or protected information.

FOR FURTHER INFORMATION CONTACT: Laura McCue, Office of Protected Resources, NMFS, (301) 427-8401. Electronic copies of the applications and supporting documents, as well as a list of the references cited in this document, may be obtained online at: www.nmfs.noaa.gov/pr/permits/incidental/energy_other.htm. In case of problems accessing these documents, please call the contact listed above.

SUPPLEMENTARY INFORMATION:

Background

Sections 101(a)(5)(A) and (D) of the MMPA (16 U.S.C. 1361 *et seq.*) direct the Secretary of Commerce to allow, upon request, the incidental, but not intentional, taking of small numbers of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing) within a specified geographical region if certain findings are made and either regulations are issued or, if the taking is limited to harassment, a notice of a proposed authorization is provided to the public for review.

An authorization for incidental takings shall be granted if NMFS finds that the taking will have a negligible impact on the species or stock(s), will not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses (where relevant), and if the permissible methods of taking and requirements pertaining to the mitigation, monitoring and reporting of such takings are set forth.

NMFS has defined “negligible impact” as an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival.

The MMPA states that the term “take” means to harass, hunt, capture, kill or attempt to harass, hunt, capture, or kill any marine mammal.

Except with respect to certain activities not pertinent here, the MMPA defines “harassment” as: any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild (Level A harassment); or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering (Level B harassment).

National Environmental Policy Act

To comply with the National Environmental Policy Act of 1969 (NEPA; 42 U.S.C. §§ 4321 *et seq.*) and NOAA Administrative Order (NAO) 216-6A, NMFS must review our proposed action with respect to environmental consequences on the human environment.

Summary of Request

NMFS received a request from Ocean Wind for an IHA to take marine mammals incidental to Spring 2017 geophysical survey investigations off the coast of New Jersey in the

OCS-A 0498 Lease Area, designated and offered by the U.S. Bureau of Ocean Energy Management (BOEM), to support the development of an offshore wind project. Ocean Wind's request was for harassment only, and NMFS concurs that mortality is not expected to result from this activity; therefore, an IHA is appropriate.

The proposed geophysical survey activities would occur for 42 days beginning in early June 2017, and geotechnical survey activities would take place in September 2017 and last for approximately 12 days. The following specific aspects of the proposed activities are likely to result in the take of marine mammals: shallow and medium-penetration sub-bottom profilers (chirper and sparker) used during the HRG survey, and dynamically-positioned (DP) vessel thruster used in support of geotechnical survey activities. Take, by Level B Harassment only, of individuals of five species of marine mammals is anticipated to result from the specified activities. No serious injury or mortality is expected from Ocean Wind's HRG and geotechnical surveys.

Description of the Specified Activity

Overview

Ocean Wind proposes to conduct a geophysical and geotechnical survey off the coast of New Jersey in the Lease Area to support the characterization of the existing seabed and subsurface geological conditions in the Lease Area. This information is necessary to support the siting, design, and deployment of up to two meteorological data collection buoys called floating light and detection ranging buoys (FLIDARs) and up to two metocean and current buoys, as well as to obtain a baseline assessment of seabed/sub-surface soil conditions in the Lease Area to support the siting of the proposed wind farm. Surveys will include the use of the following

equipment: multi-beam depth sounder, side-scan sonar, sub-bottom profiler, and cone penetration tests (CPTs).

Dates and Duration

HRG surveys are anticipated to commence in early June 2017 and will last for approximately 42 days, including estimated weather down time. Geotechnical surveys requiring the use of the DP drill ship will take place in September 2017, at the earliest, and will last for approximately 12 days excluding weather downtime. Equipment is expected run continuously for 24 hours per day.

Specified Geographic Region

Ocean Wind's survey activities will occur in the approximately 160,480-acre Lease Area designated and offered by the BOEM, located approximately nine miles (mi) southeast of Atlantic City, New Jersey, at its closest point (see Figure 1 of the IHA application). The Lease Area falls within the New Jersey Wind Energy Area (NJ WEA; Figure 1-1 of the IHA application) with water depths ranging from 15-40 meters (m) (49-131 feet (ft)).

Detailed Description of Specific Activities

HRG Survey Activities

Marine site characterization surveys will include the following HRG survey activities:

- Depth sounding (multibeam depth sounder) to determine water depths and general bottom topography;
- Magnetic intensity measurements for detecting local variations in regional magnetic field from geological strata and potential ferrous objects on and below the bottom;

- Seafloor imaging (sidescan sonar survey) for seabed sediment classification purposes, to identify natural and man-made acoustic targets resting on the bottom as well as any anomalous features;
- Shallow penetration sub-bottom profiler (chirper) to map the near surface stratigraphy (top 0-5 meter (m) soils below seabed); and
- Medium penetration sub-bottom profiler (sparker) to map deeper subsurface stratigraphy as needed (soils down to 75-100 m below seabed).

The HRG surveys are scheduled to begin, at the earliest, on June 1, 2017. Table 1 identifies the representative survey equipment that is being considered in support of the HRG survey activities. The make and model of the listed HRG equipment will vary depending on availability but will be finalized as part of the survey preparations and contract negotiations with the survey contractor. The final selection of the survey equipment will be confirmed prior to the start of the HRG survey program. Only the make and model of the HRG equipment may change, not the types of equipment or the addition of equipment with characteristics that might have effects beyond (*i.e.*, resulting in larger ensonified areas) those considered in this proposed IHA. None of the proposed HRG survey activities will result in the disturbance of bottom habitat in the Lease Area.

Table 1. Summary of proposed HRG survey equipment.

HRG Equipment	Operating Frequencies	Source Level (Manufacturer)	Source Level (Bay State Wind Survey)*	Beamwidth (degree)	Pulse Duration (millisec)
Sonardyne Ranger 2 USBL	35-50kHz	200 dB _{Peak}	194 dB _{Peak}	180	1
Klein 3000H Sidescan Sonar ¹	445/900 kHz	245 dB _{Peak}	n/a	0.2	0.0025 to 0.4

GeoPulse Sub-bottom Profiler (chirper)	1.5 to 18 kHz	223.5 dB _{Peak}	203 dB _{Peak}	55	0.1 to 22
Geo-Source 600/800 (sparker)	50 to 5000 Hz	222 dB _{Peak} / 223 dB _{Peak}	2016 dB _{Peak} / 212 dB _{Peak}	110	1 to 10
SeaBat 7125 Multibeam Sonar ²	200/400 kHz	220 dB _{Peak}	n/a	2	0.03 to .3
*Gardline 2016, 2017 ¹ It should be noted that only one of the representative sidescan sonars would be selected for deployment. ² It should be noted that only one of the representative multibeam sonars would be selected for deployment.					

The HRG survey activities will be supported by a vessel approximately 98 to 180 feet (ft) in length and capable of maintaining course and a survey speed of approximately 4.5 knots while transiting survey lines. HRG survey activities across the Lease Area will generally be conducted at 900-meter (m) line spacing. Up to two FLIDARs and two wave buoys would be deployed within the Lease Area, and up to three potential locations for FLIDAR deployment will be investigated. At each FLIDAR and wave buoy deployment locations, the survey will be conducted along a tighter 30-m line spacing to meet the BOEM requirements as set out in the July 2015 Guidelines for Providing Geophysical, Geotechnical, and Geohazard Information Pursuant and Archeological and Historic Property Information in 30 CFR Part 585.

Given the size of the Lease Area (160,480 acres), to minimize cost, the duration of survey activities, and the period of potential impact on marine species, Ocean Wind has proposed conducting continuous HRG survey operations 24 hours per day. Based on 24-hour operations, the estimated duration of the survey activities would be approximately 42 days (including estimated weather down time).

Both NMFS and BOEM have advised that the deployment of HRG survey equipment, including the use of intermittent, impulsive sound-producing equipment operating below 200

kilohertz (kHz) (*e.g.*, sub-bottom profilers), has the potential to cause acoustic harassment to marine mammals. Based on the frequency ranges of the equipment to be used in support of the HRG survey activities (Table 1) and the hearing ranges of the marine mammals that have the potential to occur in the Lease Area during survey activities (Table 3), only the sub-bottom profilers (GeoPulse Sub-bottom Profiler and Geo-Source sparker) and Sonardyne Ranger 2 USBL fall within the established marine mammal hearing ranges and have the potential to result in Level B harassment of marine mammals. However, since the sparker systems and USBL will be used concurrently, and the sparkers are louder, only the sparkers will be used in the take analysis.

The equipment positioning systems use vessel-based underwater acoustic positioning to track equipment (in this case, the sub-bottom profiler) in very shallow to very deep water. Equipment positioning systems will be operational at all times during HRG survey data acquisition (*i.e.*, concurrent with the sub-bottom profiler operation). Sub-bottom profiling systems identify and measure various marine sediment layers that exist below the sediment/water interface. A sound source emits an acoustic signal vertically downwards into the water and a receiver monitors the return signal that has been reflected off the sea floor. Some of the acoustic signal will penetrate the seabed and be reflected when it encounters a boundary between two layers that have different acoustic impedance. The system uses this reflected energy to provide information on sediment layers beneath the sediment-water interface. A shallow penetration sub-bottom profiler will be used to map the near surface stratigraphy of the Lease Area. A Geo-Source 200/800, or similar model, medium-penetration sub-bottom profiler (sparker) will be used to map deeper subsurface stratigraphy in the Lease Area as needed (soils down to 75-100 m below seabed). The sparker is towed from a boom arm off the side of the survey vessel and

emits a downward pulse with a duration of 1 to 2 millisecond (ms) at an operating frequency of 50 to 5000 Hertz (Hz).

Geotechnical Survey Activities

Marine site characterization surveys will involve the following geotechnical survey activities:

- Sample boreholes to determine geological and geotechnical characteristics of sediments;
- Deep CPTs to determine stratigraphy and in-situ conditions of the deep surface sediments; and
- Shallow CPTs to determine stratigraphy and in-situ conditions of the near surface sediments.

It is anticipated that the geotechnical surveys will take place no sooner than September 2017. The geotechnical survey program will consist of up to 8 deep sample bore holes and adjacent 8 deep CPTs both to a depth of approximately 130 ft to 200 ft (40 m to 60 m) below the seabed, as well as 30 shallow CPTs, up to 130 ft (40 m) below seabed.

The investigation activities are anticipated to be conducted from a 250-ft to 350-ft (76 m to 107 m) DP drill ship. DP vessel thruster systems maintain their precise coordinates in waters with automatic controls. These control systems use variable levels of power to counter forces from current and wind. Operations will take place over a 24-hour period to ensure cost, the duration of survey activities, and the period of potential impact on marine species are minimized. Based on 24-hour operations, the estimated duration of the geotechnical survey activities would be approximately 12 days excluding weather downtime. Estimated weather downtime is approximately 10 days.

Field studies conducted off the coast of Virginia (Tetra Tech 2014) to determine the underwater noise produced by borehole drilling and CPTs confirm that these activities do not

result in underwater noise levels that are harmful or harassing to marine mammals (*i.e.*, do not exceed NMFS' current Level A and Level B harassment thresholds for marine mammals).

However, the initial field verification conducted for the Bay State Wind Lease Area indicates that Level B harassment of marine mammals is likely at approximately 590 ft (180 m) from the DP thruster sound source (Gardline 2016). The underwater continuous noise produced by the thrusters associated with the DP drill ship that will be used to support the geotechnical activities has the potential to result in Level B harassment of marine mammals.

Proposed mitigation, monitoring, and reporting measures are described in detail later in the document (Mitigation section and Monitoring and Reporting section).

Description of Marine Mammals in the Area of the Specified Activity

There are 35 species of marine mammals that potentially occur in the Northwest Atlantic OCS region (BOEM 2014) (Table 2). The majority of these species are pelagic and/or northern species, or are so rarely sighted that their presence in the Lease Area is unlikely. Five marine mammal species are listed under the Endangered Species Act (ESA) and are known to be present, at least seasonally, in the waters off the Northwest Atlantic OCS: blue whale, fin whale, right whale, sei whale, and sperm whale. These species are highly migratory and do not spend extended periods of time in a localized area. The waters off the Northwest Atlantic OCS (including the Lease Area) are primarily used as a stopover point for these species during seasonal movements north or south between important feeding and breeding grounds. While fin whales have the potential to occur within the Lease Area, the sperm, blue, and sei whales are more pelagic and/or northern species, and although their presence within the Lease Area is possible, they are considered less common with regards to sightings. In particular, while sperm whales are known to occur occasionally in the region, their sightings are considered rare and thus

their presence in the Lease Area at the time of the proposed activities is considered unlikely. These large whale species are generally migratory and typically do not spend extended periods of time in a localized area. The waters of the Mid-Atlantic (including the Lease Area) are primarily used as areas where animals occur seasonally to feed, or as habitat during seasonal movements between the more northward feeding areas and southern hemisphere breeding grounds typically used by some of the large whale species. The mid-sized whale species (minke), large baleen whales, and the sperm whale are present year-round in the continental shelf and slope waters and may occur in the waters of the Lease Area though movements will vary with prey availability and other habitat factors. North Atlantic right whales do occur seasonally in the area; however, we did not calculate take for this species based on the low seasonal density and short duration of project activities. Because the potential for sperm whale, blue whale, and sei whale to occur within the Lease Area during the marine survey period is unlikely, these species will not be described further in this analysis.

Because the potential for many of the odontocete species to occur within the Lease Area during the marine survey period is unlikely, given that these species are either extralimital or are found more often offshore and do not occur as often on the outer continental shelf, these species will not be described further in this analysis. Bottlenose dolphins, short-beaked common dolphin, and harbor porpoise, however, do occur in the lease area, and are described below. 3

While stranding data indicate that gray seals have the potential to occur within the Lease Area, multiple sources indicate that their presence would not be likely within the Lease Area. BOEM (2012) indicates that the presence of gray seals would not be likely. Furthermore, Northeast Navy Operations Area (OPAREA) Density Estimates indicate that data for gray seals

in the Mid-Atlantic are so lacking that density estimates for this species are not possible (DoN 2007). Therefore, gray seals will not be described further in this analysis.

We have reviewed Ocean Wind’s species information—which summarizes available information regarding status and trends, distribution and habitat preferences, behavior and life history, and auditory capabilities of the potentially affected species—for accuracy and completeness and refer the reader to Sections 3 and 4 of the applications, as well as to NMFS’ Stock Assessment Reports (SAR; www.nmfs.noaa.gov/pr/sars/), instead of reprinting all of the information here. Additional general information about these species (*e.g.*, physical and behavioral descriptions) may be found on NMFS’s website (www.nmfs.noaa.gov/pr/species/mammals/). Table 2 lists all species with expected potential for occurrence in the NE Atlantic OCS and summarizes information related to the population or stock, including potential biological removal (PBR), where known. For taxonomy, we follow Committee on Taxonomy (2016). PBR, defined by the MMPA as the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population, is considered in concert with known sources of ongoing anthropogenic mortality to assess the population-level effects of the anticipated mortality from a specific project (as described in NMFS’s SARs). While no mortality is anticipated or authorized here, PBR and annual serious injury and mortality are included here as gross indicators of the status of the species and other threats. For status of species, we provide information regarding U.S. regulatory status under the MMPA and ESA.

Marine mammal abundance estimates presented in this document represent the total number of individuals that make up a given stock or the total number estimated within a

particular study area. NMFS's stock abundance estimates for most species represent the total estimate of individuals within the geographic area, if known, that comprises that stock. For some species, this geographic area may extend beyond U.S. waters. Survey abundance (as compared to stock or species abundance) is the total number of individuals estimated within the survey area, which may or may not align completely with a stock's geographic range as defined in the SARs. These surveys may also extend beyond U.S. waters.

Five species are considered to have the potential to co-occur with the proposed survey activities: fin whale (*Balaenoptera physalus*), bottlenose dolphin (*Tursiops truncatus*), short-beaked common dolphin (*Delphinus delphis*), harbor porpoise (*Phocoena phocoena*), and harbor seal (*Phoca vitulina*) (Right Whale Consortium 2016). All managed stocks in this region are assessed in NMFS's U.S. 2016 Atlantic SARs and can be found here:

<http://www.nmfs.noaa.gov/pr/species/>. All values presented in Table 2 are the most recent available at the time of publication and are available in the draft 2016 SARs.

Table 2. Marine mammals known to occur in the waters off the Northwest Atlantic OCS.

Common Name	Stock	NMFS MMPA and ESA Status; Strategic (Y/N) ¹	Stock Abundance (CV,Nmin, most recent abundance survey) ²	PBR ³	Occurrence and seasonality in the NW Atlantic OCS
Toothed whale (Odontoceti)					
Atlantic white-sided dolphin (<i>Lagenorhynchus acutus</i>)	W. North Atlantic	--; N	48,819 (0.61; 30,403; n/a)	304	rare
Atlantic spotted dolphin (<i>Stenella frontalis</i>)	W. North Atlantic	--; N	44,715 (0.43; 31,610; n/a)	316	rare
Bottlenose dolphin (<i>Tursiops truncatus</i>)	W. North Atlantic, Offshore	--; N	77,532 (0.40; 56,053; 2011)	561	Common year round
Clymene Dolphin (<i>Stenella clymene</i>)	W. North Atlantic	--; N	Unknown (unk; unk; n/a)	Undet	rare
Pantropical Spotted Dolphin (<i>Stenella attenuata</i>)	W. North Atlantic	--; N	3,333 (0.91; 1,733; n/a)	17	rare
Risso's dolphin (<i>Grampus griseus</i>)	W. North Atlantic	--; N	18,250 (0.46; 12,619; n/a)	126	rare
Short-beaked common dolphin (<i>Delphinus delphis</i>)	W. North Atlantic	--; N	70,184 (0.28; 55,690; 2011)	557	Common year round

Striped dolphin (<i>Stenella coeruleoalba</i>)	W. North Atlantic	--; N	54,807 (0.3; 42,804; n/a)	428	rare
Spinner Dolphin (<i>Stenella longirostris</i>)	W. North Atlantic	--; N	Unknown (unk; unk; n/a)	Undet	rare
White-beaked dolphin (<i>Lagenorhynchus albirostris</i>)	W. North Atlantic	--; N	2,003 (0.94; 1,023; n/a)	10	rare
Harbor porpoise (<i>Phocoena phocoena</i>)	Gulf of Maine/Bay of Fundy	--; N	79,833 (0.32; 61,415; 2011)	706	Common year round
Killer whale (<i>Orcinus orca</i>)	W. North Atlantic	--; N	Unknown (unk; unk; n/a)	Undet	rare
False killer whale (<i>Pseudorca crassidens</i>)	W. North Atlantic	--; Y	442 (1.06; 212; n/a)	2.1	rare
Long-finned pilot whale (<i>Globicephala melas</i>)	W. North Atlantic	--; Y	5,636 (0.63; 3,464; n/a)	35	rare
Short-finned pilot whale (<i>Globicephala macrorhynchus</i>)	W. North Atlantic	--; Y	21,515 (0.37; 15,913; n/a)	159	rare
Sperm whale (<i>Physeter macrocephalus</i>)	North Atlantic	E; Y	2,288 (0.28; 1,815; n/a)	3.6	Year round in continental shelf and slope waters, occur seasonally to forage
Pygmy sperm whale (<i>Kogia breviceps</i>)	W. North Atlantic	--; N	3,785 ^{b/} (0.47; 2,598; n/a)	26	rare
Dwarf sperm whale (<i>Kogia sima</i>)	W. North Atlantic	--; N	3,785 ^{b/} (0.47; 2,598; n/a)	26	rare
Cuvier's beaked whale (<i>Ziphius cavirostris</i>)	W. North Atlantic	--; N	6,532 (0.32; 5,021; n/a)	50	rare
Blainville's beaked whale (<i>Mesoplodon densirostris</i>)	W. North Atlantic	--; N	7,092 ^{c/} (0.54; 4,632; n/a)	46	rare
Gervais' beaked whale (<i>Mesoplodon europaeus</i>)	W. North Atlantic	--; N	7,092 ^{c/} (0.54; 4,632; n/a)	46	rare
True's beaked whale (<i>Mesoplodon mirus</i>)	W. North Atlantic	--; N	7,092 ^{c/} (0.54; 4,632; n/a)	46	rare
Sowerby's Beaked Whale (<i>Mesoplodon bidens</i>)	W. North Atlantic	--; N	7,092 ^{c/} (0.54; 4,632; n/a)	46	rare
Melon-headed whale (<i>Peponocephala electra</i>)	W. North Atlantic	--; N	Unknown (unk; unk; n/a)	Undet	rare
Baleen whales (Mysticeti)					
Minke whale (<i>Balaenoptera acutorostrata</i>)	Canadian East Coast	--; N	2,591 (0.81; 1,425; n/a)	162	Year round in continental shelf and slope waters, occur seasonally to forage
Blue whale (<i>Balaenoptera musculus</i>)	W. North Atlantic	E; Y	Unknown (unk; 440; n/a)	0.9	Year round in continental shelf and slope waters, occur seasonally to forage
Fin whale (<i>Balaenoptera physalus</i>)	W. North Atlantic	E; Y	1,618 (0.33; 1,234; n/a)	2.5	Year round in continental shelf and slope waters, occur seasonally to forage
Humpback whale (<i>Megaptera novaeangliae</i>)	Gulf of Maine	--; N	823 (0; 823; n/a)	2.7	Common year round
North Atlantic right whale (<i>Eubalaena glacialis</i>)	W. North Atlantic	E; Y	440 (0; 440; n/a)	1	Year round in continental shelf and slope waters, occur seasonally to forage.
Sei whale (<i>Balaenoptera borealis</i>)	Nova Scotia	E; Y	357 (0.52; 236; n/a)	0.5	Year round in continental shelf and slope waters, occur seasonally to forage

Earless seals (Phocidae)					
Gray seals (<i>Halichoerus grypus</i>)	North Atlantic	--; N	505,000 (unk; unk; n/a)	Undet	Unlikely
Harbor seals (<i>Phoca vitulina</i>)	W. North Atlantic	--; N	75,834 (0.15; 66,884; 2012)	2,006	Common year round
Hooded seals (<i>Cystophora cristata</i>)	W. North Atlantic	--; N	Unknown (unk; unk; n/a)	Undet	rare
Harp seal (<i>Phoca groenlandica</i>)	North Atlantic	--; N	Unknown (unk; unk; n/a)	Undet	rare

¹ESA status: Endangered (E), Threatened (T)/MMPA status: Depleted (D). A dash (-) indicates that the species is not listed under the ESA or designated as depleted under the MMPA. Under the MMPA, a strategic stock is one for which the level of direct human-caused mortality exceeds PBR (see footnote 3) or which is determined to be declining and likely to be listed under the ESA within the foreseeable future. Any species or stock listed under the ESA is automatically designated under the MMPA as depleted and as a strategic stock.

²CV is coefficient of variation; N_{\min} is the minimum estimate of stock abundance. In some cases, CV is not applicable. For certain stocks, abundance estimates are actual counts of animals and there is no associated CV. The most recent abundance survey that is reflected in the abundance estimate is presented; there may be more recent surveys that have not yet been incorporated into the estimate. All values presented here are from the draft 2016 Pacific SARs.

³Potential biological removal, defined by the MMPA as the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population size (OSP).

Fin whales

Fin whales are common in waters of the U. S. Atlantic Exclusive Economic Zone (EEZ), principally from Cape Hatteras northward (Waring *et al.*, 2016). Fin whales are present north of 35-degree latitude in every season and are broadly distributed throughout the western North Atlantic for most of the year (Waring *et al.*, 2016). This area (east of Montauk Point) represents a major feeding ground for fin whales from March through October. Fin whales are found in small groups of up to 5 individuals (Brueggeman *et al.*, 1987).

The current abundance estimate for the western North Atlantic stock of fin whales is 1,618 with PBR at 2.5 animals (Waring *et al.*, 2016). This stock is listed as endangered under the ESA resulting in strategic and depleted status under the MMPA. The main threats to this stock are fishery interactions and vessel collisions (Waring *et al.*, 2016).

Bottlenose dolphin

There are two distinct bottlenose dolphin morphotypes: the coastal and offshore forms in the western North Atlantic (Waring *et al.*, 2016). The offshore form is distributed primarily along the outer continental shelf and continental slope in the Northwest Atlantic Ocean from Georges Bank to the Florida Keys, and is the only type that may be present in the Lease Area.

The current abundance estimate for this stock is 77,532 with PBR at 561 (Waring *et al.*, 2016). The main threat to this species is interactions with fisheries. This species is not listed under the ESA and is not considered strategic or depleted under the MMPA.

Short-beaked common dolphin

The short-beaked common dolphin is found world-wide in temperate to subtropical seas. In the North Atlantic, short-beaked common dolphins are commonly found over the continental shelf between the 100-m and 2000-m isobaths and over prominent underwater topography and east to the mid-Atlantic Ridge (Waring *et al.*, 2016). Only the western North Atlantic stock may be present in the Lease Area.

The current abundance estimate for this stock is 70,184 with PBR at 557 (Waring *et al.*, 2016). The main threat to this species is interactions with fisheries. This species is not listed under the ESA and is not considered strategic or depleted under the MMPA.

Harbor porpoise

In the Lease Area, only the Gulf of Maine/Bay of Fundy stock may be present. This stock is found in U.S. and Canadian Atlantic waters and are concentrated in the northern Gulf of Maine and southern Bay of Fundy region, generally in waters less than 150 m deep (Waring *et al.*, 2016). They are seen from the coastline to deep waters (>1800 m; Westgate *et al.* 1998), although the majority of the population is found over the continental shelf (Waring *et al.*, 2016).

Average group size for this stock in the Bay of Fundy is approximately 4 individuals (Palka 2007).

The current abundance estimate for this stock is 79,883, with PBR at 706 (Waring *et al.*, 2016). The main threat to this species is interactions with fisheries, with documented take in the U.S. northeast sink gillnet, mid-Atlantic gillnet, and northeast bottom trawl fisheries and in the Canadian herring weir fisheries (Waring *et al.*, 2016). This species is not listed under the ESA and is not considered strategic or depleted under the MMPA.

Harbor seal

The harbor seal is found in all nearshore waters of the North Atlantic and North Pacific Oceans and adjoining seas above about 30° N (Burns 2009). In the western North Atlantic, they are distributed from the eastern Canadian Arctic and Greenland south to southern New England and New York, and occasionally to the Carolinas (Waring *et al.*, 2016). Haulout and pupping sites are located off Manomet, MA and the Isles of Shoals, ME, but generally do not occur in areas in southern New England (Waring *et al.*, 2016).

The current abundance estimate for this stock is 75,834, with PBR at 2,006 (Waring *et al.*, 2016). The main threat to this species is interactions with fisheries. This species is not listed under the ESA and is not considered strategic or depleted under the MMPA.

Potential Effects of the Specified Activity on Marine Mammals and Their Habitat

This section includes a summary and discussion of the ways that components of the specified activity may impact marine mammals and their habitat. The *Estimated Take by Incidental Harassment* section later in this document will include a quantitative analysis of the number of individuals that are expected to be taken by this activity. The *Negligible Impact Analysis and Determination* section will consider the content of this section, the *Estimated Take*

by *Incidental Harassment* section, and the *Proposed Mitigation* section, to draw conclusions regarding the likely impacts of these activities on the reproductive success or survivorship of individuals and how those impacts on individuals are likely to impact marine mammal species or stocks.

Background on Sound

Sound is a physical phenomenon consisting of minute vibrations that travel through a medium, such as air or water, and is generally characterized by several variables. Frequency describes the sound's pitch and is measured in Hz or kHz, while sound level describes the sound's intensity and is measured in decibels (dB). Sound level increases or decreases exponentially with each dB of change. The logarithmic nature of the scale means that each 10-dB increase is a 10-fold increase in acoustic power (and a 20-dB increase is then a 100-fold increase in power). A 10-fold increase in acoustic power does not mean that the sound is perceived as being 10 times louder, however. Sound levels are compared to a reference sound pressure (micro-Pascal) to identify the medium. For air and water, these reference pressures are "re: 20 μ Pa" and "re: 1 μ Pa," respectively. Root mean square (RMS) is the quadratic mean sound pressure over the duration of an impulse. RMS is calculated by squaring all of the sound amplitudes, averaging the squares, and then taking the square root of the average (Urick 1975). RMS accounts for both positive and negative values; squaring the pressures makes all values positive so that they may be accounted for in the summation of pressure levels. This measurement is often used in the context of discussing behavioral effects, in part because behavioral effects, which often result from auditory cues, may be better expressed through averaged units rather than by peak pressures.

Acoustic Impacts

HRG survey equipment use and use of the DP thruster during the geophysical and geotechnical surveys may temporarily impact marine mammals in the area due to elevated in-water sound levels. Marine mammals are continually exposed to many sources of sound. Naturally occurring sounds such as lightning, rain, sub-sea earthquakes, and biological sounds (*e.g.*, snapping shrimp, whale songs) are widespread throughout the world's oceans. Marine mammals produce sounds in various contexts and use sound for various biological functions including, but not limited to: (1) social interactions; (2) foraging; (3) orientation; and (4) predator detection. Interference with producing or receiving these sounds may result in adverse impacts. Audible distance, or received levels of sound depend on the nature of the sound source, ambient noise conditions, and the sensitivity of the receptor to the sound (Richardson *et al.*, 1995). Type and significance of marine mammal reactions to sound are likely dependent on a variety of factors including, but not limited to, (1) the behavioral state of the animal (*e.g.*, feeding, traveling, etc.); (2) frequency of the sound; (3) distance between the animal and the source; and (4) the level of the sound relative to ambient conditions (Southall *et al.*, 2007).

When considering the influence of various kinds of sound on the marine environment, it is necessary to understand that different kinds of marine life are sensitive to different frequencies of sound. Current data indicate that not all marine mammal species have equal hearing capabilities (Richardson *et al.*, 1995; Wartzok and Ketten, 1999; Au and Hastings, 2008).

Animals are less sensitive to sounds at the outer edges of their functional hearing range and are more sensitive to a range of frequencies within the middle of their functional hearing range. For mid-frequency cetaceans, functional hearing estimates occur between approximately 150 Hz and 160 kHz with best hearing estimated to occur between approximately 10 to less than

100 kHz (Finneran *et al.*, 2005 and 2009, Natchtigall *et al.*, 2005 and 2008; Yuen *et al.*, 2005; Popov *et al.*, 2011; and Schlundt *et al.*, 2011).

On August 4, 2016, NMFS released its Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (NMFS 2016; 81 FR 51694). This new guidance established new thresholds for predicting onset of temporary (TTS) and permanent (PTS) threshold shifts for impulsive (*e.g.*, explosives and impact pile drivers) and non-impulsive (*e.g.*, vibratory pile drivers) sound sources. These acoustic thresholds are presented using dual metrics of cumulative sound exposure level (SELcum) and peak sound level (PK) for impulsive sounds and SELcum for non-impulsive sounds. The lower and/or upper frequencies for some of these functional hearing groups have been modified from those designated by Southall *et al.* (2007), and the revised generalized hearing ranges are presented in the new Guidance. The functional hearing groups and the associated frequencies are indicated in Table 3 below.

Table 3. Marine mammal hearing groups and their generalized hearing range.

Hearing Group	Generalized Hearing Range*
Low-frequency (LF) cetaceans (baleen whales)	7 Hz to 35 kHz
Mid-frequency (MF) cetaceans (dolphins, toothed whales, beaked whales, bottlenose whales)	150 Hz to 160 kHz
High-frequency (HF) cetaceans (true porpoises, <i>Kogia</i> , river dolphins, cephalorhynchid, <i>Lagenorhynchus cruciger</i> and <i>L. australis</i>)	275 Hz to 160 kHz
Phocid pinnipeds (PW) (underwater) (true seals)	50 Hz to 86 kHz
Otariid pinnipeds (OW) (underwater) (sea lions and fur seals)	60 Hz to 39 kHz
* Represents the generalized hearing range for the entire group as a composite (<i>i.e.</i> , all species within the group), where individual species' hearing ranges are typically not as broad. Generalized hearing range chosen based on ~65 dB threshold from normalized composite audiogram, with the exception for lower limits for LF cetaceans (Southall <i>et al.</i> , 2007) and PW pinniped (approximation).	

When sound travels (propagates) from its source, its loudness decreases as the distance traveled by the sound increases. Thus, the loudness of a sound at its source is higher than the

loudness of that same sound a kilometer (km) away. Acousticians often refer to the loudness of a sound at its source (typically referenced to one meter from the source) as the source level and the loudness of sound elsewhere as the received level (*i.e.*, typically the receiver). For example, a humpback whale 3 km from a device that has a source level of 230 dB may only be exposed to sound that is 160 dB loud, depending on how the sound travels through water (*e.g.*, spherical spreading (6 dB reduction with doubling of distance) was used in this example). As a result, it is important to understand the difference between source levels and received levels when discussing the loudness of sound in the ocean or its impacts on the marine environment.

As sound travels from a source, its propagation in water is influenced by various physical characteristics, including water temperature, depth, salinity, and surface and bottom properties that cause refraction, reflection, absorption, and scattering of sound waves. Oceans are not homogeneous and the contribution of each of these individual factors is extremely complex and interrelated. The physical characteristics that determine the sound's speed through the water will change with depth, season, geographic location, and with time of day (as a result, in actual active sonar operations, crews will measure oceanic conditions, such as sea water temperature and depth, to calibrate models that determine the path the sonar signal will take as it travels through the ocean and how strong the sound signal will be at a given range along a particular transmission path). As sound travels through the ocean, the intensity associated with the wavefront diminishes, or attenuates. This decrease in intensity is referred to as propagation loss, also commonly called transmission loss.

As mentioned previously in this document, five marine mammal species (four cetaceans and one pinniped) are likely to occur in the Lease Area. Of the four cetacean species likely to occur in the Lease Area, one classified as low-frequency cetaceans (*i.e.*, fin whale), two are

classified as mid-frequency cetaceans (*i.e.*, Atlantic white-sided dolphin and bottlenose dolphin), and one is classified as a high-frequency cetacean (*i.e.*, harbor porpoise) (Southall *et al.*, 2007). A species' functional hearing group is a consideration when we analyze the effects of exposure to sound on marine mammals.

Hearing Impairment

Marine mammals may experience temporary or permanent hearing impairment when exposed to loud sounds. Hearing impairment is classified by TTS and PTS. There are no empirical data for onset of PTS in any marine mammal; therefore, PTS-onset must be estimated from TTS-onset measurements and from the rate of TTS growth with increasing exposure levels above the level eliciting TTS-onset. PTS is presumed to be likely if the hearing threshold is reduced by ≥ 40 dB (that is, 40 dB of TTS). PTS is considered auditory injury (Southall *et al.*, 2007) and occurs in a specific frequency range and amount. Irreparable damage to the inner or outer cochlear hair cells may cause PTS; however, other mechanisms are also involved, such as exceeding the elastic limits of certain tissues and membranes in the middle and inner ears and resultant changes in the chemical composition of the inner ear fluids (Southall *et al.*, 2007). Given the higher level of sound and longer durations of exposure necessary to cause PTS as compared with TTS, it is considerably less likely that PTS would occur during the proposed HRG and geotechnical survey.

Temporary Threshold Shift (TTS)

TTS is the mildest form of hearing impairment that can occur during exposure to a loud sound (Kryter 1985). While experiencing TTS, the hearing threshold rises and a sound must be stronger in order to be heard. At least in terrestrial mammals, TTS can last from minutes or hours to (in cases of strong TTS) days, can be limited to a particular frequency range, and can

occur to varying degrees (*i.e.*, a loss of a certain number of dBs of sensitivity). For sound exposures at or somewhat above the TTS threshold, hearing sensitivity in both terrestrial and marine mammals recovers rapidly after exposure to the noise ends.

Marine mammal hearing plays a critical role in communication with conspecifics and in interpretation of environmental cues for purposes such as predator avoidance and prey capture. Depending on the degree (elevation of threshold in dB), duration (*i.e.*, recovery time), and frequency range of TTS and the context in which it is experienced, TTS can have effects on marine mammals ranging from discountable to serious. For example, a marine mammal may be able to readily compensate for a brief, relatively small amount of TTS in a non-critical frequency range that takes place during a time when the animal is traveling through the open ocean, where ambient noise is lower and there are not as many competing sounds present. Alternatively, a larger amount and longer duration of TTS sustained during a time when communication is critical for successful mother/calf interactions could have more serious impacts if it were in the same frequency band as the necessary vocalizations and of a severity that it impeded communication. The fact that animals exposed to levels and durations of sound that would be expected to result in this physiological response would also be expected to have behavioral responses of a comparatively more severe or sustained nature is also notable and potentially of more importance than the simple existence of a TTS.

Currently, TTS data only exist for four species of cetaceans (bottlenose dolphin, beluga whale (*Delphinapterus leucas*), harbor porpoise, and Yangtze finless porpoise (*Neophocaena phocaenoides*)) and three species of pinnipeds (northern elephant seal (*Mirounga angustirostris*), harbor seal, and California sea lion (*Zalophus californianus*)) exposed to a limited number of sound sources (*i.e.*, mostly tones and octave-band noise) in laboratory settings (*e.g.*, Finneran *et*

al., 2002 and 2010; Nachtigall *et al.*, 2004; Kastak *et al.*, 2005; Lucke *et al.*, 2009; Mooney *et al.*, 2009; Popov *et al.*, 2011; Finneran and Schlundt, 2010). In general, harbor seals (Kastak *et al.*, 2005; Kastelein *et al.*, 2012a) and harbor porpoises (Lucke *et al.*, 2009; Kastelein *et al.*, 2012b) have a lower TTS onset than other measured pinniped or cetacean species. However, even for these animals, which are better able to hear higher frequencies and may be more sensitive to higher frequencies, exposures on the order of approximately 170 dB rms or higher for brief transient signals are likely required for even temporary (recoverable) changes in hearing sensitivity that would likely not be categorized as physiologically damaging (Lucke *et al.*, 2009). Additionally, the existing marine mammal TTS data come from a limited number of individuals within these species. There are no data available on noise-induced hearing loss for mysticetes. For summaries of data on TTS in marine mammals or for further discussion of TTS onset thresholds, please see Finneran (2016).

Scientific literature highlights the inherent complexity of predicting TTS onset in marine mammals, as well as the importance of considering exposure duration when assessing potential impacts (Mooney *et al.*, 2009a, 2009b; Kastak *et al.*, 2007). Generally, with sound exposures of equal energy, quieter sounds (lower SPL) of longer duration were found to induce TTS onset more than louder sounds (higher SPL) of shorter duration (more similar to sub-bottom profilers). For intermittent sounds, less threshold shift will occur than from a continuous exposure with the same energy (some recovery will occur between intermittent exposures) (Kryter *et al.*, 1966; Ward 1997). For sound exposures at or somewhat above the TTS-onset threshold, hearing sensitivity recovers rapidly after exposure to the sound ends; intermittent exposures recover faster in comparison with continuous exposures of the same duration (Finneran *et al.*, 2010). NMFS considers TTS as Level B harassment that is mediated by physiological effects on the

auditory system; however, NMFS does not consider TTS-onset to be the lowest level at which Level B harassment may occur.

Animals in the Lease Area during the HRG survey are unlikely to incur TTS hearing impairment due to the characteristics of the sound sources, which include low source levels (208 to 221 dB re 1 μ Pa-m) and generally very short pulses and duration of the sound. Even for high-frequency cetacean species (*e.g.*, harbor porpoises), which may have increased sensitivity to TTS (Lucke *et al.*, 2009; Kastelein *et al.*, 2012b), individuals would have to make a very close approach and also remain very close to vessels operating these sources in order to receive multiple exposures at relatively high levels, as would be necessary to cause TTS. Intermittent exposures—as would occur due to the brief, transient signals produced by these sources—require a higher cumulative SEL to induce TTS than would continuous exposures of the same duration (*i.e.*, intermittent exposure results in lower levels of TTS) (Mooney *et al.*, 2009a; Finneran *et al.*, 2010). Moreover, most marine mammals would more likely avoid a loud sound source rather than swim in such close proximity as to result in TTS. Kremser *et al.* (2005) noted that the probability of a cetacean swimming through the area of exposure when a sub-bottom profiler emits a pulse is small—because if the animal was in the area, it would have to pass the transducer at close range in order to be subjected to sound levels that could cause TTS and would likely exhibit avoidance behavior to the area near the transducer rather than swim through at such a close range. Further, the restricted beam shape of the sub-bottom profiler and other HRG survey equipment makes it unlikely that an animal would be exposed more than briefly during the passage of the vessel. Boebel *et al.* (2005) concluded similarly for single and multibeam echosounders and, more recently, Lurton (2016) conducted a modeling exercise and concluded similarly that likely potential for acoustic injury from these types of systems is negligible but that

behavioral response cannot be ruled out. Animals may avoid the area around the survey vessels, thereby reducing exposure. Any disturbance to marine mammals is likely to be in the form of temporary avoidance or alteration of opportunistic foraging behavior near the survey location.

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Masking

Masking is the obscuring of sounds of interest to an animal by other sounds, typically at similar frequencies. Marine mammals are highly dependent on sound, and their ability to recognize sound signals amid other sound is important in communication and detection of both predators and prey (Tyack 2000). Background ambient sound may interfere with or mask the ability of an animal to detect a sound signal even when that signal is above its absolute hearing threshold. Even in the absence of anthropogenic sound, the marine environment is often loud. Natural ambient sound includes contributions from wind, waves, precipitation, other animals, and (at frequencies above 30 kHz) thermal sound resulting from molecular agitation (Richardson *et al.*, 1995).

Background sound may also include anthropogenic sound, and masking of natural sounds can result when human activities produce high levels of background sound. Conversely, if the background level of underwater sound is high (*e.g.*, on a day with strong wind and high waves), an anthropogenic sound source would not be detectable as far away as would be possible under quieter conditions and would itself be masked. Ambient sound is highly variable on continental shelves (Myrberg 1978; Desharnais *et al.*, 1999). This results in a high degree of variability in the range at which marine mammals can detect anthropogenic sounds.

Although masking is a phenomenon which may occur naturally, the introduction of loud anthropogenic sounds into the marine environment at frequencies important to marine mammals increases the severity and frequency of occurrence of masking. For example, if a baleen whale is exposed to continuous low-frequency sound from an industrial source, this would reduce the size of the area around that whale within which it can hear the calls of another whale. The components of background noise that are similar in frequency to the signal in question primarily determine the degree of masking of that signal. In general, little is known about the degree to which marine mammals rely upon detection of sounds from conspecifics, predators, prey, or other natural sources. In the absence of specific information about the importance of detecting these natural sounds, it is not possible to predict the impact of masking on marine mammals (Richardson *et al.*, 1995). In general, masking effects are expected to be less severe when sounds are transient than when they are continuous. Masking is typically of greater concern for those marine mammals that utilize low-frequency communications, such as baleen whales, because of how far low-frequency sounds propagate.

Marine mammal communications would not likely be masked appreciably by the sub-bottom profiler signals given the directionality of the signal and the brief period when an individual mammal is likely to be within its beam. And while continuous sound from the DP thruster when in use is predicted to extend 500 m to the 120 dB threshold, the generally short duration of DP thruster use and low source levels, coupled with the likelihood of animals to avoid the sound source, would result in very little opportunity for this activity to mask the communication of local marine mammals for more than a brief period of time.

Non-auditory Physical Effects (Stress)

Classic stress responses begin when an animal's central nervous system perceives a potential threat to its homeostasis. That perception triggers stress responses regardless of whether a stimulus actually threatens the animal; the mere perception of a threat is sufficient to trigger a stress response (Moberg 2000; Seyle 1950). Once an animal's central nervous system perceives a threat, it mounts a biological response or defense that consists of a combination of the four general biological defense responses: behavioral responses, autonomic nervous system responses, neuroendocrine responses, or immune responses.

In the case of many stressors, an animal's first and sometimes most economical (in terms of biotic costs) response is behavioral avoidance of the potential stressor or avoidance of continued exposure to a stressor. An animal's second line of defense to stressors involves the sympathetic part of the autonomic nervous system and the classical "fight or flight" response which includes the cardiovascular system, the gastrointestinal system, the exocrine glands, and the adrenal medulla to produce changes in heart rate, blood pressure, and gastrointestinal activity that humans commonly associate with "stress." These responses have a relatively short duration and may or may not have significant long-term effect on an animal's welfare.

An animal's third line of defense to stressors involves its neuroendocrine systems; the system that has received the most study has been the hypothalamus-pituitary-adrenal system (also known as the HPA axis in mammals or the hypothalamus-pituitary-interrenal axis in fish and some reptiles). Unlike stress responses associated with the autonomic nervous system, virtually all neuro-endocrine functions that are affected by stress – including immune competence, reproduction, metabolism, and behavior – are regulated by pituitary hormones. Stress-induced changes in the secretion of pituitary hormones have been implicated in failed reproduction (Moberg 1987; Rivier 1995), altered metabolism (Elasser *et al.*, 2000), reduced

immune competence (Blecha 2000), and behavioral disturbance. Increases in the circulation of glucocorticosteroids (cortisol, corticosterone, and aldosterone in marine mammals; see Romano *et al.*, 2004) have been equated with stress for many years.

The primary distinction between stress (which is adaptive and does not normally place an animal at risk) and distress is the biotic cost of the response. During a stress response, an animal uses glycogen stores that can be quickly replenished once the stress is alleviated. In such circumstances, the cost of the stress response would not pose a risk to the animal's welfare. However, when an animal does not have sufficient energy reserves to satisfy the energetic costs of a stress response, energy resources must be diverted from other biotic function, which impairs those functions that experience the diversion. For example, when mounting a stress response diverts energy away from growth in young animals, those animals may experience stunted growth. When mounting a stress response diverts energy from a fetus, an animal's reproductive success and its fitness will suffer. In these cases, the animals will have entered a pre-pathological or pathological state which is called "distress" (Seyle 1950) or "allostatic loading" (McEwen and Wingfield 2003). This pathological state will last until the animal replenishes its biotic reserves sufficient to restore normal function. Note that these examples involved a long-term (days or weeks) stress response exposure to stimuli.

Relationships between these physiological mechanisms, animal behavior, and the costs of stress responses have also been documented fairly well through controlled experiments; because this physiology exists in every vertebrate that has been studied, it is not surprising that stress responses and their costs have been documented in both laboratory and free-living animals (for examples see, Holberton *et al.*, 1996; Hood *et al.*, 1998; Jessop *et al.*, 2003; Krausman *et al.*, 2004; Lankford *et al.*, 2005; Reneerkens *et al.*, 2002; Thompson and Hamer, 2000). Information

has also been collected on the physiological responses of marine mammals to exposure to anthropogenic sounds (Fair and Becker 2000; Romano *et al.*, 2002). For example, Rolland *et al.* (2012) found that noise reduction from reduced ship traffic in the Bay of Fundy was associated with decreased stress in North Atlantic right whales. In a conceptual model developed by the Population Consequences of Acoustic Disturbance (PCAD) working group, serum hormones were identified as possible indicators of behavioral effects that are translated into altered rates of reproduction and mortality.

Studies of other marine animals and terrestrial animals would also lead us to expect some marine mammals to experience physiological stress responses and, perhaps, physiological responses that would be classified as “distress” upon exposure to high frequency, mid-frequency and low-frequency sounds. For example, Jansen (1998) reported on the relationship between acoustic exposures and physiological responses that are indicative of stress responses in humans (for example, elevated respiration and increased heart rates). Jones (1998) reported on reductions in human performance when faced with acute, repetitive exposures to acoustic disturbance. Trimper *et al.* (1998) reported on the physiological stress responses of osprey to low-level aircraft noise while Krausman *et al.* (2004) reported on the auditory and physiology stress responses of endangered Sonoran pronghorn to military overflights. Smith *et al.* (2004a, 2004b), for example, identified noise-induced physiological transient stress responses in hearing-specialist fish (*i.e.*, goldfish) that accompanied short- and long-term hearing losses. Welch and Welch (1970) reported physiological and behavioral stress responses that accompanied damage to the inner ears of fish and several mammals.

Hearing is one of the primary senses marine mammals use to gather information about their environment and to communicate with conspecifics. Although empirical information on the

relationship between sensory impairment (TTS, PTS, and acoustic masking) on marine mammals remains limited, it seems reasonable to assume that reducing an animal's ability to gather information about its environment and to communicate with other members of its species would be stressful for animals that use hearing as their primary sensory mechanism. Therefore, we assume that acoustic exposures sufficient to trigger onset PTS or TTS would be accompanied by physiological stress responses because terrestrial animals exhibit those responses under similar conditions (NRC 2003). More importantly, marine mammals might experience stress responses at received levels lower than those necessary to trigger onset TTS. Based on empirical studies of the time required to recover from stress responses (Moberg 2000), we also assume that stress responses are likely to persist beyond the time interval required for animals to recover from TTS and might result in pathological and pre-pathological states that would be as significant as behavioral responses to TTS.

In general, there are few data on the potential for strong, anthropogenic underwater sounds to cause non-auditory physical effects in marine mammals. Such effects, if they occur at all, would presumably be limited to short distances and to activities that extend over a prolonged period. The available data do not allow identification of a specific exposure level above which non-auditory effects can be expected (Southall *et al.*, 2007). There is no definitive evidence that any of these effects occur even for marine mammals in close proximity to an anthropogenic sound source. In addition, marine mammals that show behavioral avoidance of survey vessels and related sound sources are unlikely to incur non-auditory impairment or other physical effects. NMFS does not expect that the generally short-term, intermittent, and transitory HRG and geotechnical activities would create conditions of long-term, continuous noise and chronic acoustic exposure leading to long-term physiological stress responses in marine mammals.

Behavioral Disturbance

Behavioral disturbance may include a variety of effects, including subtle changes in behavior (*e.g.*, minor or brief avoidance of an area or changes in vocalizations), more conspicuous changes in similar behavioral activities, and more sustained and/or potentially severe reactions, such as displacement from or abandonment of high-quality habitat. Behavioral responses to sound are highly variable and context-specific and any reactions depend on numerous intrinsic and extrinsic factors (*e.g.*, species, state of maturity, experience, current activity, reproductive state, auditory sensitivity, time of day), as well as the interplay between factors (*e.g.*, Richardson *et al.*, 1995; Wartzok *et al.*, 2003; Southall *et al.*, 2007; Weilgart, 2007; Archer *et al.*, 2010). Behavioral reactions can vary not only among individuals but also within an individual, depending on previous experience with a sound source, context, and numerous other factors (Ellison *et al.*, 2012), and can vary depending on characteristics associated with the sound source (*e.g.*, whether it is moving or stationary, number of sources, distance from the source). Please see Appendices B-C of Southall *et al.* (2007) for a review of studies involving marine mammal behavioral responses to sound.

Habituation can occur when an animal's response to a stimulus wanes with repeated exposure, usually in the absence of unpleasant associated events (Wartzok *et al.*, 2003). Animals are most likely to habituate to sounds that are predictable and unvarying. It is important to note that habituation is appropriately considered as a "progressive reduction in response to stimuli that are perceived as neither aversive nor beneficial," rather than as, more generally, moderation in response to human disturbance (Bejder *et al.*, 2009). The opposite process is sensitization, when an unpleasant experience leads to subsequent responses, often in the form of avoidance, at a lower level of exposure. As noted, behavioral state may affect the type of response. For

example, animals that are resting may show greater behavioral change in response to disturbing sound levels than animals that are highly motivated to remain in an area for feeding (Richardson *et al.*, 1995; NRC 2003; Wartzok *et al.*, 2003). Controlled experiments with captive marine mammals have shown pronounced behavioral reactions, including avoidance of loud sound sources (Ridgway *et al.*, 1997; Finneran *et al.*, 2003). Observed responses of wild marine mammals to loud, pulsed sound sources (typically seismic airguns or acoustic harassment devices) have been varied but often consist of avoidance behavior or other behavioral changes suggesting discomfort (Morton and Symonds, 2002; see also Richardson *et al.*, 1995; Nowacek *et al.*, 2007).

Available studies show wide variation in response to underwater sound; therefore, it is difficult to predict specifically how any given sound in a particular instance might affect marine mammals perceiving the signal. If a marine mammal does react briefly to an underwater sound by changing its behavior or moving a small distance, the impacts of the change are unlikely to be significant to the individual, let alone the stock or population. However, if a sound source displaces marine mammals from an important feeding or breeding area for a prolonged period, impacts on individuals and populations could be significant (*e.g.*, Lusseau and Bejder, 2007; Weilgart 2007; NRC 2005). However, there are broad categories of potential response, which we describe in greater detail here, that include alteration of dive behavior, alteration of foraging behavior, effects to breathing, interference with or alteration of vocalization, avoidance, and flight.

Changes in dive behavior can vary widely and may consist of increased or decreased dive times and surface intervals as well as changes in the rates of ascent and descent during a dive (*e.g.*, Frankel and Clark 2000; Costa *et al.*, 2003; Ng and Leung 2003; Nowacek *et al.*, 2004;

Goldbogen *et al.*, 2013a,b). Variations in dive behavior may reflect interruptions in biologically significant activities (*e.g.*, foraging) or they may be of little biological significance. The impact of an alteration to dive behavior resulting from an acoustic exposure depends on what the animal is doing at the time of the exposure and the type and magnitude of the response.

Disruption of feeding behavior can be difficult to correlate with anthropogenic sound exposure, so it is usually inferred by observed displacement from known foraging areas, the appearance of secondary indicators (*e.g.*, bubble nets or sediment plumes), or changes in dive behavior. As for other types of behavioral response, the frequency, duration, and temporal pattern of signal presentation, as well as differences in species sensitivity, are likely contributing factors to differences in response in any given circumstance (*e.g.*, Croll *et al.*, 2001; Nowacek *et al.*; 2004; Madsen *et al.*, 2006; Yazvenko *et al.*, 2007). A determination of whether foraging disruptions incur fitness consequences would require information on or estimates of the energetic requirements of the affected individuals and the relationship between prey availability, foraging effort and success, and the life history stage of the animal.

Variations in respiration naturally vary with different behaviors and alterations to breathing rate as a function of acoustic exposure can be expected to co-occur with other behavioral reactions, such as a flight response or an alteration in diving. However, respiration rates in and of themselves may be representative of annoyance or an acute stress response. Various studies have shown that respiration rates may either be unaffected or could increase, depending on the species and signal characteristics, again highlighting the importance in understanding species differences in the tolerance of underwater noise when determining the potential for impacts resulting from anthropogenic sound exposure (*e.g.*, Kastelein *et al.*, 2001, 2005b, 2006; Gailey *et al.*, 2007).

Marine mammals vocalize for different purposes and across multiple modes, such as whistling, echolocation click production, calling, and singing. Changes in vocalization behavior in response to anthropogenic noise can occur for any of these modes and may result from a need to compete with an increase in background noise or may reflect increased vigilance or a startle response. For example, in the presence of potentially masking signals, humpback whales and killer whales have been observed to increase the length of their songs (Miller *et al.*, 2000; Fristrup *et al.*, 2003; Foote *et al.*, 2004), while right whales have been observed to shift the frequency content of their calls upward while reducing the rate of calling in areas of increased anthropogenic noise (Parks *et al.*, 2007b). In some cases, animals may cease sound production during production of aversive signals (Bowles *et al.*, 1994).

Avoidance is the displacement of an individual from an area or migration path as a result of the presence of a sound or other stressors, and is one of the most obvious manifestations of disturbance in marine mammals (Richardson *et al.*, 1995). For example, gray whales are known to change direction – deflecting from customary migratory paths – in order to avoid noise from seismic surveys (Malme *et al.*, 1984). Avoidance may be short-term, with animals returning to the area once the noise has ceased (*e.g.*, Bowles *et al.*, 1994; Goold 1996; Stone *et al.*, 2000; Morton and Symonds, 2002; Gailey *et al.*, 2007). Longer-term displacement is possible, however, which may lead to changes in abundance or distribution patterns of the affected species in the affected region if habituation to the presence of the sound does not occur (*e.g.*, Blackwell *et al.*, 2004; Bejder *et al.*, 2006; Teilmann *et al.*, 2006).

A flight response is a dramatic change in normal movement to a directed and rapid movement away from the perceived location of a sound source. The flight response differs from other avoidance responses in the intensity of the response (*e.g.*, directed movement, rate of

travel). Relatively little information on flight responses of marine mammals to anthropogenic signals exist, although observations of flight responses to the presence of predators have occurred (Connor and Heithaus, 1996). The result of a flight response could range from brief, temporary exertion and displacement from the area where the signal provokes flight to, in extreme cases, marine mammal strandings (Evans and England, 2001). However, it should be noted that response to a perceived predator does not necessarily invoke flight (Ford and Reeves, 2008) and whether individuals are solitary or in groups may influence the response.

Behavioral disturbance can also impact marine mammals in more subtle ways. Increased vigilance may result in costs related to diversion of focus and attention (*i.e.*, when a response consists of increased vigilance, it may come at the cost of decreased attention to other critical behaviors such as foraging or resting). These effects have generally not been demonstrated for marine mammals, but studies involving fish and terrestrial animals have shown that increased vigilance may substantially reduce feeding rates (*e.g.*, Beauchamp and Livoreil, 1997; Fritz *et al.*, 2002; Purser and Radford, 2011). In addition, chronic disturbance can cause population declines through reduction of fitness (*e.g.*, decline in body condition) and subsequent reduction in reproductive success, survival, or both (*e.g.*, Harrington and Veitch, 1992; Daan *et al.*, 1996; Bradshaw *et al.*, 1998). However, Ridgway *et al.* (2006) reported that increased vigilance in bottlenose dolphins exposed to sound over a five-day period did not cause any sleep deprivation or stress effects.

Many animals perform vital functions, such as feeding, resting, traveling, and socializing, on a diel cycle (24-hour cycle). Disruption of such functions resulting from reactions to stressors such as sound exposure are more likely to be significant if they last more than one diel cycle or recur on subsequent days (Southall *et al.*, 2007). Consequently, a behavioral response lasting less

than one day and not recurring on subsequent days is not considered particularly severe unless it could directly affect reproduction or survival (Southall *et al.*, 2007). Note that there is a difference between multi-day substantive behavioral reactions and multi-day anthropogenic activities. For example, just because an activity lasts for multiple days does not necessarily mean that individual animals are either exposed to activity-related stressors for multiple days or, further, exposed in a manner resulting in sustained multi-day substantive behavioral responses.

Marine mammals are likely to avoid the HRG survey activity, especially the naturally shy harbor porpoise, while the harbor seals might be attracted to them out of curiosity. However, because the sub-bottom profilers and other HRG survey equipment operate from a moving vessel, and the maximum radius to the 160 dB harassment threshold is less than 200 m, the area and time that this equipment would be affecting a given location is very small. Further, once an area has been surveyed, it is not likely that it will be surveyed again, therefore reducing the likelihood of repeated HRG-related impacts within the survey area. And while the drill ship using DP thrusters will generally remain stationary during geotechnical survey activities, the short duration (up to 12 days) of the DP thruster use would likely result in only short-term and temporary avoidance of the area, rather than permanent abandonment, by marine mammals.

We have also considered the potential for severe behavioral responses such as stranding and associated indirect injury or mortality from Ocean Wind's use of HRG survey equipment, on the basis of a 2008 mass stranding of approximately one hundred melon-headed whales in a Madagascar lagoon system. An investigation of the event indicated that use of a high-frequency mapping system (12-kHz multibeam echosounder) was the most plausible and likely initial behavioral trigger of the event, while providing the caveat that there is no unequivocal and easily identifiable single cause (Southall *et al.*, 2013). The investigatory panel's conclusion was based

on (1) very close temporal and spatial association and directed movement of the survey with the stranding event; (2) the unusual nature of such an event coupled with previously documented apparent behavioral sensitivity of the species to other sound types (Southall *et al.*, 2006; Brownell *et al.*, 2009); and (3) the fact that all other possible factors considered were determined to be unlikely causes. Specifically, regarding survey patterns prior to the event and in relation to bathymetry, the vessel transited in a north-south direction on the shelf break parallel to the shore, ensonifying large areas of deep-water habitat prior to operating intermittently in a concentrated area offshore from the stranding site; this may have trapped the animals between the sound source and the shore, thus driving them towards the lagoon system. The investigatory panel systematically excluded or deemed highly unlikely nearly all potential reasons for these animals leaving their typical pelagic habitat for an area extremely atypical for the species (*i.e.*, a shallow lagoon system). Notably, this was the first time that such a system has been associated with a stranding event. The panel also noted several site- and situation-specific secondary factors that may have contributed to the avoidance responses that led to the eventual entrapment and mortality of the whales. Specifically, shoreward-directed surface currents and elevated chlorophyll levels in the area preceding the event may have played a role (Southall *et al.*, 2013). The report also notes that prior use of a similar system in the general area may have sensitized the animals and also concluded that, for odontocete cetaceans that hear well in higher frequency ranges where ambient noise is typically quite low, high-power active sonars operating in this range may be more easily audible and have potential effects over larger areas than low frequency systems that have more typically been considered in terms of anthropogenic noise impacts. It is, however, important to note that the relatively lower output frequency, higher output power, and complex nature of the system implicated in this event, in context of the other factors noted here,

likely produced a fairly unusual set of circumstances that indicate that such events would likely remain rare and are not necessarily relevant to use of lower-power, higher-frequency systems more commonly used for HRG survey applications. The risk of similar events recurring may be very low, given the extensive use of active acoustic systems used for scientific and navigational purposes worldwide on a daily basis and the lack of direct evidence of such responses previously reported.

Tolerance

Numerous studies have shown that underwater sounds from industrial activities are often readily detectable by marine mammals in the water at distances of many km. However, other studies have shown that marine mammals at distances more than a few km away often show no apparent response to industrial activities of various types (Miller *et al.*, 2005). This is often true even in cases when the sounds must be readily audible to the animals based on measured received levels and the hearing sensitivity of that mammal group. Although various baleen whales, toothed whales, and (less frequently) pinnipeds have been shown to react behaviorally to underwater sound from sources such as airgun pulses or vessels under some conditions, at other times, mammals of all three types have shown no overt reactions (*e.g.*, Malme *et al.*, 1986; Richardson *et al.*, 1995; Madsen and Mohl 2000; Croll *et al.*, 2001; Jacobs and Terhune 2002; Madsen *et al.*, 2002; Miller *et al.*, 2005). In general, pinnipeds seem to be more tolerant of exposure to some types of underwater sound than are baleen whales. Richardson *et al.* (1995) found that vessel sound does not seem to strongly affect pinnipeds that are already in the water. Richardson *et al.* (1995) went on to explain that seals on haul-outs sometimes respond strongly to the presence of vessels and at other times appear to show considerable tolerance of vessels, and Brueggeman *et al.* (1992) observed ringed seals (*Pusa hispida*) hauled out on ice pans

displaying short-term escape reactions when a ship approached within 0.16-0.31 mi (0.25-0.5 km). Due to the relatively high vessel traffic in the Lease Area it is possible that marine mammals are habituated to noise (*e.g.*, DP thrusters) from project vessels in the area.

Vessel Strike

Ship strikes of marine mammals can cause major wounds, which may lead to the death of the animal. An animal at the surface could be struck directly by a vessel, a surfacing animal could hit the bottom of a vessel, or a vessel's propeller could injure an animal just below the surface. The severity of injuries typically depends on the size and speed of the vessel (Knowlton and Kraus 2001; Laist *et al.*, 2001; Vanderlaan and Taggart 2007).

The most vulnerable marine mammals are those that spend extended periods of time at the surface in order to restore oxygen levels within their tissues after deep dives (*e.g.*, the sperm whale). In addition, some baleen whales, such as the North Atlantic right whale, seem generally unresponsive to vessel sound, making them more susceptible to vessel collisions (Nowacek *et al.*, 2004). These species are primarily large, slow moving whales. Smaller marine mammals (*e.g.*, bottlenose dolphin) move quickly through the water column and are often seen riding the bow wave of large ships. Marine mammal responses to vessels may include avoidance and changes in dive pattern (NRC 2003).

An examination of all known ship strikes from all shipping sources (civilian and military) indicates vessel speed is a principal factor in whether a vessel strike results in death (Knowlton and Kraus 2001; Laist *et al.*, 2001; Jensen and Silber 2003; Vanderlaan and Taggart 2007). In assessing records with known vessel speeds, Laist *et al.* (2001) found a direct relationship between the occurrence of a whale strike and the speed of the vessel involved in the collision. The authors concluded that most deaths occurred when a vessel was traveling in excess of 24.1

km/h (14.9 mph; 13 kn). Given the slow vessel speeds and predictable course necessary for data acquisition, ship strike is unlikely to occur during the geophysical and geotechnical surveys.

Marine mammals would be able to easily avoid the applicant's vessel due to the slow speeds and are likely already habituated to the presence of numerous vessels in the area. Further, Ocean Wind shall implement measures (*e.g.*, vessel speed restrictions and separation distances; see *Proposed Mitigation Measures*) set forth in the BOEM Lease to reduce the risk of a vessel strike to marine mammal species in the Lease Area.

There are no rookeries or mating grounds known to be biologically important to marine mammals within the proposed project area. The area is an important feeding area for fin whales. There is no designated critical habitat for any ESA-listed marine mammals. NMFS' regulations at 50 CFR part 224 designated the nearshore waters of the Mid-Atlantic Bight as the Mid-Atlantic U.S. Seasonal Management Area (SMA) for right whales in 2008. Mandatory vessel speed restrictions (less than 10 knots) are in place in that SMA from November 1 through April 30 to reduce the threat of collisions between ships and right whales around their migratory route and calving grounds.

Bottom disturbance associated with the HRG survey activities may include grab sampling to validate the seabed classification obtained from the multibeam echosounder/sidescan sonar data. This will typically be accomplished using a Mini-Harmon Grab with 0.1 m² sample area or the slightly larger Harmon Grab with a 0.2 m² sample area. Bottom disturbance associated with the geotechnical survey activities will consist of the 8 deep bore holes of approximately 3 to 4 inches (in; 7.6 to 10.1 centimeters [cm]) diameter, the 30 shallow CPTs of up to approximately 2 in (5 cm) in diameter, and the 8 deep CPTs of approximately 2 in (5 cm) in diameter. Impact on marine mammal habitat from these activities will be temporary, insignificant, and discountable.

Because of the temporary nature of the disturbance, the availability of similar habitat and resources (*e.g.*, prey species) in the surrounding area, and the lack of important or unique marine mammal habitat, the impacts to marine mammals and the food sources that they utilize are not expected to cause significant or long-term consequences for individual marine mammals or their populations.

Estimated Take

This section provides an estimate of the number of incidental takes proposed for authorization through this IHA, which will inform both NMFS' consideration of whether the number of takes is "small" and the negligible impact determination.

Harassment is the only type of take expected to result from these activities. Except with respect to certain activities not pertinent here, the MMPA defines "harassment" as: any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild (Level A harassment); or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering (Level B harassment).

Authorized takes would be by Level B harassment only, in the form of disruption of behavioral patterns for individual marine mammals resulting from exposure to HRG and geotechnical surveys. Based on the nature of the activity, the short duration of activities, and the small Level A isopleths (less than 3 m for all sources), Level A harassment is neither anticipated nor proposed to be authorized. The death of a marine mammal is also a type of incidental take. However, as described previously, no mortality is anticipated or proposed to be authorized for this activity. Below we describe how the take is estimated for this project.

Project activities that have the potential to harass marine mammals, as defined by the MMPA, include underwater noise from operation of the HRG survey sub-bottom profilers and noise propagation associated with the use of DP thrusters during geotechnical survey activities that require the use of a DP drill ship. NMFS anticipates that impacts to marine mammals would be in the form of behavioral harassment, and no take by injury, serious injury, or mortality is proposed.

The basis for the take estimate is the number of marine mammals that would be exposed to sound levels in excess of NMFS' Level B harassment criteria for impulsive noise (160 dB re 1 μ Pa (rms) and continuous noise (120 dB re 1 μ Pa (rms)), which is generally determined by overlaying the area ensonified above NMFS acoustic thresholds for harassment within a day with the density of marine mammals, and multiplying by the number of days. NMFS' current acoustic thresholds for estimating take are shown in Table 4 below.

Table 4. NMFS's acoustic exposure criteria.

Criterion	Definition	Threshold
Level B harassment (underwater)	Behavioral disruption	160 dB (impulsive source) / 120 dB (continuous source) (rms)
Level B harassment (airborne)	Behavioral disruption	90 dB (harbor seals) / 100 dB (other pinnipeds) (unweighted)

Modeling took into consideration sound sources using the potential operational parameters, bathymetry, geoacoustic properties of the Lease Area, time of year, and marine mammal hearing ranges. Results from the hydroacoustic modeling and measurements showed that estimated maximum distance to the 160 dB re 1 μ Pa (rms) MMPA threshold for all water depths for the HRG survey sub-bottom profilers (the HRG survey equipment with the greatest potential for effect on marine mammal) was approximately 75.28 m from the source using

practical spreading (Subacoustech 2016), and the estimated maximum critical distance to the 120 dB re 1 μ Pa (rms) MMPA threshold for all water depths for the drill ship DP thruster was approximately 500 m from the source (Subacoustech 2016). Ocean Wind and NMFS believe that these estimates represent the a conservative scenario and that the actual distances to the Level B harassment threshold may be shorter, as practical spreading ($15\log R$) was used to estimate the ensonified area here and there are some sound measurements taken in the Northeast that suggest a higher spreading coefficient (which would result in a shorter distance) may be applicable.

Ocean Wind estimated species densities within the proposed project area in order to estimate the number of marine mammal exposures to sound levels above the 120 dB Level B harassment threshold for continuous noise (*i.e.*, DP thrusters) and the 160 dB Level B harassment threshold for intermittent, impulsive noise (*i.e.*, sub-bottom profiler). Research indicates that marine mammals generally have extremely fine auditory temporal resolution and can detect each signal separately (*e.g.*, Au *et al.*, 1988; Dolphin *et al.*, 1995; Supin and Popov 1995; Mooney *et al.*, 2009b), especially for species with echolocation capabilities. Therefore, it is likely that marine mammals would perceive the acoustic signals associated with the HRG survey equipment as being intermittent rather than continuous, and we base our takes from these sources on exposures to the 160 dB threshold.

The data used as the basis for estimating cetacean density (“D”) for the Lease Area are sightings per unit effort (SPUE) derived by Duke University (Roberts *et al.*, 2016). For pinnipeds, the only available comprehensive data for seal abundance is the Northeast Navy Operations Area (OPAREA) Density Estimates (DoN 2007). SPUE (or, the relative abundance of species) is derived by using a measure of survey effort and number of individual cetaceans

sighted. SPUE allows for comparison between discrete units of time (*i.e.* seasons) and space within a project area (Shoop and Kenney, 1992). The Duke University (Roberts *et al.*, 2016) cetacean density data represent models derived from aggregating line-transect surveys conducted over 23 years by 5 institutions (NOAA NMFS Northeast Fisheries Science Center (NEFSC), New Jersey Department of Environmental Protection (NJDEP), NOAA NMFS Southeast Fisheries Science Center (SEFSC), University of North Carolina Wilmington (UNCW), Virginia Aquarium & Marine Science Center (VAMSC)), the results of which are freely available online at the Ocean Biogeographic Information System Spatial Ecological Analysis of Megavertebrate Populations (OBIS-SEAMAP) repository. Monthly density values were within the survey area were averaged by season to provide seasonal density estimates. The OPAREA Density Estimates (DoN 2007) used for pinniped densities were based on data collected through NMFS NWFSC aerial surveys conducted between 1998 and 2005.

The Zone of influence (ZOI) is the extent of the ensonified zone in a given day. The ZOI was calculated using the following equations:

- Stationary source (*e.g.* DP thruster): πr^2
- Mobile source (*e.g.* sparkers): $(\text{distance/day} * 2r) + \pi r^2$

Where distance is the maximum survey trackline per day (177.6 km) and r is the distance to the 160 dB (for impulsive sources) and 120 dB (for non-impulsive sources) isopleths. The isopleths were calculated using practical spreading.

Estimated takes were calculated by multiplying the species density (animals per km²) by the appropriate ZOI, multiplied by the number of appropriate days (*e.g.* 42 for HRG activities or 12 for geotechnical activities) of the specified activity. A detailed description of the acoustic

modeling used to calculate zones of influence is provided in Ocean Wind's IHA application (also see the discussion in the *Mitigation* section below).

Ocean Wind used a ZOI of 26.757 km² and a survey period of 42 days, which includes estimated weather downtime, to estimate take from use of the HRG survey equipment during geophysical survey activities. The ZOI is based on the worst case (since it assumes the higher powered GeoSource 800 sparker will be operating all the time) and a maximum survey trackline of 110.4 mi (177.6 km) per day. Based on the proposed HRG survey schedule (June 2017), take calculations were based on the spring seasonal species density as derived from Roberts et al. (2016) for cetaceans and seasonal OPAREA density estimates (DoN, 2007) for pinnipeds. The resulting take estimates (rounded to the nearest whole number) are presented in Table 6.

Table 6. Estimated Level B harassment takes for HRG survey activities.

Species	Density for Spring (No./ km ²)	Calculated Take (No.)	Requested Take Authorization (No.)	Percentage of Stock Potentially Affected
North Atlantic Right Whale	.0000	0.00	0	0
Humpback Whale	.0001	0.11	0	0
Fin Whale	.0008	0.89	5*	0.061
Sperm whale	.0001	0.11	0	0
Minke Whale	.0002	0.22	0	0
Bottlenose Dolphin	.2534	284.7	285	0.385
Short beaked common Dolphin	.0282	31.69	32	0.047
Harbor Porpoise	.0012	1.34	4*	0.006
Harbor Seal	0.0000	0.00	0	0

*Requested take authorization was increased to account for average group size of fin whales (5) and harbor porpoise (4).

Ocean Wind used a ZOI of 0.31 m² (0.79 km²) and a maximum DP thruster use period of 12 days to estimate take from use of the DP thruster during geotechnical survey activities. The ZOI represents the field-verified distance to the 120 dB isopleth for DP thruster use. Based on the proposed geotechnical survey schedule (September 2017), take calculations were based on the fall seasonal species density estimates (Roberts *et al.*, 2016; DoN, 2007) (Table 7). The resulting take estimates (rounded to the nearest whole number) based upon these conservative assumptions for bottlenose dolphins and harbor seals are presented in Table 7. These numbers

are based on 12 days and represent only 0.001 percent of the stock for each of these 2 species. Take estimates were increased to take into account average group size where needed (fin whale and harbor porpoise). Take calculations for North Atlantic right whale, humpback whale, sperm whale, and minke whale are at or near zero (refer to the Ocean Wind application); therefore, no takes for these species are requested or proposed for authorization.

Table 7. Estimated Level B harassment takes for geotechnical survey activities.

Species	Density for Fall (No./100 km ²)	Calculated Take (No.)	Requested Take Authorization (No.)	Percentage of Stock Potentially Affected
Bottlenose Dolphin	11.44	1.08	1	0.001
Harbor seal	9.74	0.92	1	0.001

Ocean Wind's requested take numbers are provided in Tables 6 and 7 and are also the number of takes NMFS is proposing to authorize. Ocean Wind's calculations do not take into account whether a single animal is harassed multiple times or whether each exposure is a different animal. Therefore, the numbers in Tables 6 and 7 are the maximum number of animals that may be harassed during the HRG and geotechnical surveys (*i.e.*, Ocean Wind assumes that each exposure event is a different animal). These estimates do not account for prescribed mitigation measures that Ocean Wind would implement during the specified activities and the fact that shutdown/powerdown procedures shall be implemented if an animal enters within 200 m of the vessel during HRG activities, and 500 m during geotechnical activities, further reducing the potential for any takes to occur during these activities.

Ocean Wind used NMFS' Guidance (NMFS 2016) to determine sound exposure thresholds to determine when an activity that produces sound might result in impacts to a marine mammal such that a take by injury, in the form of PTS, might occur. The functional hearing groups and the associated PTS onset acoustic thresholds are indicated in Table 8 below. Ocean Wind used the user spreadsheet to calculate the isopleth for the loudest source (sparker, sub-

bottom profiler). The sub-bottom profiler was calculated with the following conditions: source level at 172.4 rms, vessel velocity of 2.058 m/s, repetition rate of 0.182, pulse duration of 22 ms and a weighting factor adjustment of 10 based on the spectrogram for this equipment (Gardline 2016). Isopleths were less than 3 m for all hearing groups; therefore, no Level A takes are requested. The Geo-source sparker model used the following parameters: source level at 188.7 rms Source level, vessel velocity of 2.058 meters per second (m/s), repetition rate of 0.25 seconds, pulse duration of 10 ms and weighting factor adjustment of 3 based on the spectrograms for this equipment. Isopleths were less than 2 m for all hearing groups; therefore, no Level A takes are requested. The DP thruster was defined as non-impulsive static continuous source with an extrapolated source level of 150 dB rms based on far field measurements (Subacoustech 2016), an activity duration of 4 hours and weighting factor adjustment of 2. The transmission loss coefficient of 11.1 was used based on the slope of best fit from field measurements (Subacoustech 2016). Isopleths were less than 1 m for all hearing groups; therefore, no Level A take are requested. No level A take is requested or proposed to be authorized for any of the sources used during HRG and geotechnical surveys.

Table 8. Summary of PTS onset acoustic thresholds¹.

	PTS Onset Acoustic Thresholds* (Received Level)	
Hearing Group	Impulsive	Non-impulsive
Low-frequency cetaceans	<i>Cell 1</i> Lpk,flat: 219 dB LE,LF,24h: 183 dB	<i>Cell 2</i> LE,LF,24h: 199 dB
Mid-frequency cetaceans	<i>Cell 3</i> Lpk,flat: 230 dB LE,MF,24h: 185 dB	<i>Cell 4</i> LE,MF,24h: 198 dB
High-frequency cetaceans	<i>Cell 5</i> Lpk,flat: 202 dB LE,HF,24h: 155 dB	<i>Cell 6</i> LE,HF,24h: 173 dB
Phocid Pinnipeds (underwaters)	<i>Cell 7</i> Lpk,flat: 218 dB LE,PW,24h: 185 dB	<i>Cell 8</i> LE,PW,24h: 201 dB
Otariid Pinnipeds (underwater)	<i>Cell 9</i> Lpk,flat: 232 dB LE,OW,24h: 203 dB	<i>Cell 10</i> LE,OW,24h: 219 dB

Proposed Mitigation

In order to issue an IHA under Section 101(a)(5)(D) of the MMPA, NMFS must set forth the permissible methods of taking pursuant to such activity, “and other means of effecting the least practicable impact on such species or stock and its habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance, and on the availability of such species or stock for taking” for certain subsistence uses (latter not applicable for this action). NMFS regulations require applicants for incidental take authorizations to include information about the availability and feasibility (economic and technological) of equipment, methods, and manner of conducting such activity or other means of effecting the least practicable adverse impact upon the affected species or stocks and their habitat (50 CFR 216.104(a)(11)).

In evaluating how mitigation may or may not be appropriate to ensure the least practicable adverse impact on species or stocks and their habitat, as well as subsistence uses where applicable, we carefully balance two primary factors: 1) the manner in which, and the degree to which, the successful implementation of the measure(s) is expected to reduce impacts to marine mammals, marine mammal species or stocks, and their habitat, which considers the nature of the potential adverse impact being mitigated (likelihood, scope, range), as well as the likelihood that the measure will be effective if implemented; and the likelihood of effective implementation, and; 2) the practicability of the measures for applicant implementation, which may consider such things as cost, impact on operations, and, in the case of a military readiness activity, personnel safety, practicality of implementation, and impact on the effectiveness of the military readiness activity.

With NMFS’ input during the application process, and as per the BOEM Lease, Ocean Wind is proposing the following mitigation measures during site characterization surveys

utilizing HRG survey equipment and use of the DP thruster. The mitigation measures outlined in this section are based on protocols and procedures that have been successfully implemented and resulted in no observed take of marine mammals for similar offshore projects and previously approved by NMFS (ESS 2013; Dominion 2013 and 2014).

Marine Mammal Exclusion Zones

Protected species observers (PSOs) will monitor the following exclusion/monitoring zones for the presence of marine mammals:

- A 200-m exclusion zone during HRG surveys (this exceeds the estimated Level B harassment isopleth).
- A 500-m monitoring zone during the use of DP thrusters during geotechnical survey activities (this is equal to the Level B harassment isopleth).

The 200 m exclusion zone is the default exclusion zone specified in stipulation 4.4.6.1 of the New Jersey OCS-A 0498 Lease Agreement. The 500 m exclusion zone is based on field-verified distances established during similar survey work conducted within the Bay State Wind Lease Area (Subacoustech 2016).

Visual Monitoring

Visual monitoring of the established exclusion zone(s) for the HRG and geotechnical surveys will be performed by qualified and NMFS-approved PSOs, the resumes of whom will be provided to NMFS for review and approval prior to the start of survey activities. An observer team comprising a minimum of four NMFS-approved PSOs and two certified Passive Acoustic Monitoring (PAM) operators (PAM operators will not function as PSOs), operating in shifts, will be stationed aboard either the survey vessel or a dedicated PSO-vessel. PSOs and PAM operators will work in shifts such that no one monitor will work more than 4 consecutive hours

without a 2-hour break or longer than 12 hours during any 24-hour period. During daylight hours the PSOs will rotate in shifts of one on and three off, while during nighttime operations PSOs will work in pairs. The PAM operators will also be on call as necessary during daytime operations should visual observations become impaired. Each PSO will monitor 360 degrees of the field of vision.

PSOs will be responsible for visually monitoring and identifying marine mammals approaching or within the established exclusion zone(s) during survey activities. It will be the responsibility of the Lead PSO on duty to communicate the presence of marine mammals as well as to communicate and enforce the action(s) that are necessary to ensure mitigation and monitoring requirements are implemented as appropriate. PAM operators will communicate detected vocalizations to the Lead PSO on duty, who will then be responsible for implementing the necessary mitigation procedures. A mitigation and monitoring communications flow diagram has been included as Appendix A in the IHA application.

PSOs will be equipped with binoculars and have the ability to estimate distances to marine mammals located in proximity to the vessel and/or exclusion zone using range finders. Reticulated binoculars will also be available to PSOs for use as appropriate based on conditions and visibility to support the siting and monitoring of marine species. Digital single-lens reflex camera equipment will be used to record sightings and verify species identification. During night operations, PAM (see *Passive Acoustic Monitoring* requirements below) and night-vision equipment in combination with infrared technology will be used (Additional details and specifications are provided in Ocean Wind's application in Appendix B for night-vision devices and Appendix C for infrared video monitoring technology). Position data will be recorded using hand-held or vessel global positioning system (GPS) units for each sighting.

The PSOs will begin observation of the exclusion zone(s) at least 60 minutes prior to ramp-up of HRG survey equipment. Use of noise-producing equipment will not begin until the exclusion zone is clear of all marine mammals for at least 60 minutes, as per the requirements of the BOEM Lease.

If a marine mammal is detected approaching or entering the 200-m exclusion zones during the HRG survey, or the 500-m monitoring zone during DP thrusters use, the vessel operator would adhere to the shutdown (during HRG survey) or powerdown (during DP thruster use) procedures described below to minimize noise impacts on the animals.

At all times, the vessel operator will maintain a separation distance of 500 m from any sighted North Atlantic right whale as stipulated in the *Vessel Strike Avoidance* procedures described below. These stated requirements will be included in the site-specific training to be provided to the survey team.

Vessel Strike Avoidance

The Applicant will ensure that vessel operators and crew maintain a vigilant watch for cetaceans and pinnipeds and slow down or stop their vessels to avoid striking these species. Survey vessel crew members responsible for navigation duties will receive site-specific training on marine mammal and sea turtle sighting/reporting and vessel strike avoidance measures. Vessel strike avoidance measures will include the following, except under extraordinary circumstances when complying with these requirements would put the safety of the vessel or crew at risk:

- All vessel operators will comply with 10 knot (<18.5 km per hour [km/h]) speed restrictions in any Dynamic Management Area (DMA). In addition, all vessels operating from November 1 through July 31 will operate at speeds of 10 knots (<18.5 km/h) or less.

- All survey vessels will maintain a separation distance of 500 m or greater from any sighted North Atlantic right whale.
- If underway, vessels must steer a course away from any sighted North Atlantic right whale at 10 knots (<18.5 km/h) or less until the 500 m minimum separation distance has been established. If a North Atlantic right whale is sighted in a vessel's path, or within 100 m to an underway vessel, the underway vessel must reduce speed and shift the engine to neutral. Engines will not be engaged until the North Atlantic right whale has moved outside of the vessel's path and beyond 100 m. If stationary, the vessel must not engage engines until the North Atlantic right whale has moved beyond 100 m.
- All vessels will maintain a separation distance of 100 m or greater from any sighted non-delphinoid (*i.e.*, mysticetes and sperm whales) cetaceans. If sighted, the vessel underway must reduce speed and shift the engine to neutral and must not engage the engines until the non-delphinoid cetacean has moved outside of the vessel's path and beyond 100 m. If a survey vessel is stationary, the vessel will not engage engines until the non-delphinoid cetacean has moved out of the vessel's path and beyond 100 m.
- All vessels will maintain a separation distance of 50 m or greater from any sighted delphinoid cetacean. Any vessel underway will remain parallel to a sighted delphinoid cetacean's course whenever possible and avoid excessive speed or abrupt changes in direction. Any vessel underway reduces vessel speed to 10 knots or less when pods (including mother/calf pairs) or large assemblages of delphinoid cetaceans are observed. Vessels may not adjust course and speed until the delphinoid cetaceans have moved beyond 50 m and/or abeam (*i.e.*, moving away and at a right angle to the centerline of the vessel) of the underway vessel.

- All vessels will maintain a separation distance of 50 m (164 ft) or greater from any sighted pinniped.

The training program will be provided to NMFS for review and approval prior to the start of surveys. Confirmation of the training and understanding of the requirements will be documented on a training course log sheet. Signing the log sheet will certify that the crew members understand and will comply with the necessary requirements throughout the survey event.

Seasonal Operating Requirements

Between watch shifts, members of the monitoring team will consult the NMFS North Atlantic right whale reporting systems for the presence of North Atlantic right whales throughout survey operations. The proposed survey activities will, however, occur outside of the SMA located off the coasts of Delaware and New Jersey. The proposed survey activities will also occur in June/July and September, which is outside of the seasonal mandatory speed restriction period for this SMA (November 1 through April 30).

Throughout all survey operations, Ocean Wind will monitor the NMFS North Atlantic right whale reporting systems for the establishment of a DMA. If NMFS should establish a DMA in the Lease Area under survey, within 24 hours of the establishment of the DMA Ocean Wind will work with NMFS to shut down and/or alter the survey activities to avoid the DMA.

Passive Acoustic Monitoring

As per the BOEM Lease, alternative monitoring technologies (*e.g.*, active or passive acoustic monitoring) are required if a Lessee intends to conduct geophysical surveys at night or when visual observation is otherwise impaired. To support 24-hour HRG survey operations, Ocean Wind will use certified PAM operators with experience reviewing and identifying recorded marine mammal vocalizations, as part of the project monitoring during nighttime

operations to provide for optimal acquisition of species detections at night, or as needed during periods when visual observations may be impaired. In addition, PAM systems shall be employed during daylight hours to support system calibration and PSO and PAM team coordination, as well as in support of efforts to evaluate the effectiveness of the various mitigation techniques (*i.e.*, visual observations during day and night, compared to the PAM detections/operations).

Given the range of species that could occur in the Lease Area, the PAM system will consist of an array of hydrophones with both broadband (sampling mid-range frequencies of 2 kHz to 200 kHz) and at least one low-frequency hydrophone (sampling range frequencies of 75 Hz to 30 kHz). Monitoring of the PAM system will be conducted from a customized processing station aboard the HRG survey vessel. The on-board processing station provides the interface between the PAM system and the operator. The PAM operator(s) will monitor the hydrophone signals in real time both aurally (using headphones) and visually (via the monitor screen displays). Ocean Wind proposes the use of PAMGuard software for “target motion analysis” to support localization in relation to the identified exclusion zone. PAMGuard is an open source and versatile software/hardware interface to enable flexibility in the configuration of in-sea equipment (number of hydrophones, sensitivities, spacing, and geometry). PAM operators will immediately communicate detections/vocalizations to the Lead PSO on duty who will ensure the implementation of the appropriate mitigation measure (*e.g.*, shutdown) even if visual observations by PSOs have not been made.

Ramp-Up

As per the BOEM Lease, a ramp-up procedure will be used for HRG survey equipment capable of adjusting energy levels at the start or re-start of HRG survey activities. A ramp-up procedure will be used at the beginning of HRG survey activities in order to provide additional

protection to marine mammals near the Lease Area by allowing them to vacate the area prior to the commencement of survey equipment use. The ramp-up procedure will not be initiated during daytime, night time, or periods of inclement weather if the exclusion zone cannot be adequately monitored by the PSOs using the appropriate visual technology (*e.g.*, reticulated binoculars, night vision equipment) and/or PAM for a 60-minute period. A ramp-up would begin with the power of the smallest acoustic HRG equipment at its lowest practical power output appropriate for the survey. The power would then be gradually turned up and other acoustic sources added such that the source level would increase in steps not exceeding 6 dB per 5-minute period. If marine mammals are detected within the HRG survey exclusion zone prior to or during the ramp-up, activities will be delayed until the animal(s) has moved outside the monitoring zone and no marine mammals are detected for a period of 60 minutes.

The DP vessel thrusters will be engaged to support the safe operation of the vessel and crew while conducting geotechnical survey activities and require use as necessary. Therefore, there is no opportunity to engage in a ramp-up procedure.

Shutdown and Powerdown

HRG Survey - The exclusion zone(s) around the noise-producing activities (HRG survey equipment) will be monitored, as previously described, by PSOs and at night by PAM operators for the presence of marine mammals before, during, and after any noise-producing activity. The vessel operator must comply immediately with any call for shutdown by the Lead PSO. Any disagreement should be discussed only after shutdown.

As per the BOEM Lease, if a non-delphinoid (*i.e.*, mysticetes and sperm whales) cetacean is detected at or within the established exclusion zone (200-m exclusion zone), an immediate shutdown of the HRG survey equipment is required. Subsequent restart of the electromechanical

survey equipment must use the ramp-up procedures described above and may only occur following clearance of the exclusion zone for 60 minutes. These are extremely conservative shutdown zones, as the 200 -m exclusion radii exceed the distances to the estimated Level B harassment isopleths (75.28 m.).

As per the BOEM Lease, if a delphinoid cetacean or pinniped is detected at or within the exclusion zone, the HRG survey equipment (including the sub-bottom profiler) must be powered down to the lowest power output that is technically feasible. Subsequent power up of the survey equipment must use the ramp-up procedures described above and may occur after (1) the exclusion zone is clear of a delphinoid cetacean and/or pinniped for 60 minutes or (2) a determination by the PSO after a minimum of 10 minutes of observation that the delphinoid cetacean or pinniped is approaching the vessel or towed equipment at a speed and vector that indicates voluntary approach to bow-ride or chase towed equipment

If the HRG sound source (including the sub-bottom profiler) shuts down for reasons other than encroachment into the exclusion zone by a marine mammal including but not limited to a mechanical or electronic failure, resulting in the cessation of sound source for a period greater than 20 minutes, a restart for the HRG survey equipment (including the sub-bottom profiler) is required using the full ramp-up procedures and clearance of the exclusion zone of all cetaceans and pinnipeds for 60 minutes. If the pause is less than 20 minutes, the equipment may be restarted as soon as practicable at its operational level as long as visual surveys were continued diligently throughout the silent period and the exclusion zone remained clear of cetaceans and pinnipeds. If the visual surveys were not continued diligently during the pause of 20 minutes or less, a restart of the HRG survey equipment (including the sub-bottom profiler) is required using

the full ramp-up procedures and clearance of the exclusion zone for all cetaceans and pinnipeds for 60 minutes.

Geotechnical Survey (DP Thrusters) - During geotechnical survey activities, a constant position over the drill or CPT site must be maintained to ensure the integrity of the survey equipment. Any stoppage of DP thruster during the proposed geotechnical activities has the potential to result in significant damage to survey equipment. Therefore, during geotechnical survey activities, if marine mammals enter or approach the established exclusion and monitoring zone, Ocean Wind shall reduce DP thruster to the maximum extent possible, except under circumstances when reducing DP thruster use would compromise safety (both human health and environmental) and/or the integrity of the equipment. Reducing thruster energy will effectively reduce the potential for exposure of marine mammals to sound energy. After decreasing thruster energy, PSOs will continue to monitor marine mammal behavior and determine if the animal(s) is moving towards or away from the established monitoring zone. If the animal(s) continues to move towards the sound source then DP thruster use would remain at the reduced level. Normal use will resume when PSOs report that the marine mammals have moved away from and remained clear of the monitoring zone for a minimum of 60 minutes since the last sighting.

Based on our evaluation of the applicant's proposed measures, as well as other measures considered by NMFS, NMFS has preliminarily determined that the proposed mitigation measures provide the means of effecting the least practicable impact on the affected species or stocks and their habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance.

Proposed Monitoring and Reporting

In order to issue an IHA for an activity, section 101(a)(5)(D) of the MMPA states that NMFS must set forth, “requirements pertaining to the monitoring and reporting of such taking.” The MMPA implementing regulations at 50 CFR 216.104 (a)(13) indicate that requests for incidental take authorizations (ITAs) must include the suggested means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species and of the level of taking or impacts on populations of marine mammals that are expected to be present in the proposed action area. Effective reporting is critical both to compliance as well as ensuring that the most value is obtained from the required monitoring.

Monitoring measures prescribed by NMFS should contribute to improved understanding of one or more of the following general goals:

- Occurrence of marine mammal species or stocks in the action area (*e.g.*, presence, abundance, distribution, density).
- Nature, scope, or context of likely marine mammal exposure to potential stressors/impacts (individual or cumulative, acute or chronic), through better understanding of: (1) action or environment (*e.g.*, source characterization, propagation, ambient noise); (2) affected species (*e.g.*, life history, dive patterns); (3) co-occurrence of marine mammal species with the action; or (4) biological or behavioral context of exposure (*e.g.*, age, calving or feeding areas).
- Individual marine mammal responses (behavioral or physiological) to acoustic stressors (acute, chronic, or cumulative), other stressors, or cumulative impacts from multiple stressors.
- How anticipated responses to stressors impact either: (1) long-term fitness and survival of individual marine mammals; or (2) populations, species, or stocks.

- Effects on marine mammal habitat (*e.g.*, marine mammal prey species, acoustic habitat, or other important physical components of marine mammal habitat).
- Mitigation and monitoring effectiveness.

Ocean Wind submitted marine mammal monitoring and reporting measures as part of the IHA application. These measures may be modified or supplemented based on comments or new information received from the public during the public comment period.

Visual Monitoring - Visual monitoring of the established Level B harassment zones (200-m radius during HRG surveys (note that this is the same as the mitigation exclusion/shutdown zones established for HRG survey sound sources); 500-m radius during DP thruster use (note that this is the same as the mitigation powerdown zone established for DP thruster sound sources)) will be performed by qualified and NMFS-approved PSOs (see discussion of PSO qualifications and requirements in *Marine Mammal Exclusion Zones* above).

The PSOs will begin observation of the monitoring zone during all HRG survey activities and all geotechnical operations where DP thrusters are employed. Observations of the monitoring zone will continue throughout the survey activity and/or while DP thrusters are in use. PSOs will be responsible for visually monitoring and identifying marine mammals approaching or entering the established monitoring zone during survey activities.

Observations will take place from the highest available vantage point on the survey vessel. General 360-degree scanning will occur during the monitoring periods, and target scanning by the PSO will occur when alerted of a marine mammal presence.

Data on all PSO observations will be recorded based on standard PSO collection requirements. This will include dates and locations of construction operations; time of observation, location and weather; details of the sightings (*e.g.*, species, age classification (if

known), numbers, behavior); and details of any observed “taking” (behavioral disturbances or injury/mortality). The data sheet will be provided to both NMFS and BOEM for review and approval prior to the start of survey activities. In addition, prior to initiation of survey work, all crew members will undergo environmental training, a component of which will focus on the procedures for sighting and protection of marine mammals. A briefing will also be conducted between the survey supervisors and crews, the PSOs, and Ocean Wind. The purpose of the briefing will be to establish responsibilities of each party, define the chains of command, discuss communication procedures, provide an overview of monitoring purposes, and review operational procedures.

Acoustic Field Verification – As per the requirements of the BOEM Lease, field verification of the exclusion/monitoring zones will be conducted to determine whether the proposed zones correspond accurately to the relevant isopleths and are adequate to minimize impacts to marine mammals. The details of the field verification strategy will be provided in a Field Verification Plan no later than 45 days prior to the commencement of field verification activities.

Ocean Wind must conduct field verification of the exclusion zone (the 160 dB isopleth) for HRG survey equipment and the powerdown zone (the 120 dB isopleth) for DP thruster use for all equipment operating below 200 kHz. Ocean Wind must take acoustic measurements at a minimum of two reference locations and in a manner that is sufficient to establish source level (peak at 1 meter) and distance to the 160 dB isopleth (the Level B harassment zones for HRG surveys) and 120 dB isopleth (the Level B harassment zone) for DP thruster use. Sound measurements must be taken at the reference locations at two depths (*i.e.*, a depth at mid-water and a depth at approximately 1 meter (3.28 ft) above the seafloor).

Ocean Wind may use the results from its field-verification efforts to request modification of the exclusion/monitoring zones for the HRG or geotechnical surveys. Any new exclusion/monitoring zone radius proposed by Ocean Wind must be based on the most conservative measurements (*i.e.*, the largest safety zone configuration) of the target Level A or Level B harassment acoustic threshold zones. The modified zone must be used for all subsequent use of field-verified equipment. Ocean Wind must obtain approval from NMFS and BOEM of any new exclusion/monitoring zone before it may be implemented and the IHA shall be modified accordingly.

Proposed Reporting Measures

The Applicant will provide the following reports as necessary during survey activities:

- The Applicant will contact NMFS and BOEM within 24 hours of the commencement of survey activities and again within 24 hours of the completion of the activity.
- As per the BOEM Lease: Any observed significant behavioral reactions (*e.g.*, animals departing the area) or injury or mortality to any marine mammals must be reported to NMFS and BOEM within 24 hours of observation. Dead or injured protected species are reported to the NMFS Greater Atlantic Regional Fisheries Office (GARFO) Stranding Hotline (800-900-3622) within 24 hours of sighting, regardless of whether the injury is caused by a vessel. In addition, if the injury or death was caused by a collision with a project related vessel, Ocean Wind must ensure that NMFS and BOEM are notified of the strike within 24 hours. Additional reporting requirements for injured or dead animals are described below (*Notification of Injured or Dead Marine Mammals*).
- *Notification of Injured or Dead Marine Mammals* - In the unanticipated event that the specified HRG and geotechnical activities lead to an injury of a marine mammal (Level A

harassment) or mortality (*e.g.*, ship-strike, gear interaction, and/or entanglement), Ocean Wind would immediately cease the specified activities and report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources and the NOAA GARFO Stranding Coordinator. The report would include the following information:

- Time, date, and location (latitude/longitude) of the incident;
- Name and type of vessel involved;
- Vessel's speed during and leading up to the incident;
- Description of the incident;
- Status of all sound source use in the 24 hours preceding the incident;
- Water depth;
- Environmental conditions (*e.g.*, wind speed and direction, Beaufort sea state, cloud cover, and visibility);
- Description of all marine mammal observations in the 24 hours preceding the incident;
- Species identification or description of the animal(s) involved;
- Fate of the animal(s); and
- Photographs or video footage of the animal(s) (if equipment is available).

Activities would not resume until NMFS is able to review the circumstances of the event. NMFS would work with Ocean Wind to minimize reoccurrence of such an event in the future. Ocean Wind would not resume activities until notified by NMFS.

In the event that Ocean Wind discovers an injured or dead marine mammal and determines that the cause of the injury or death is unknown and the death is relatively

recent (*i.e.*, in less than a moderate state of decomposition), Ocean Wind would immediately report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources and the GARFO Stranding Coordinator. The report would include the same information identified in the paragraph above. Activities would be able to continue while NMFS reviews the circumstances of the incident. NMFS would work with Ocean Wind to determine if modifications in the activities are appropriate.

In the event that Ocean Wind discovers an injured or dead marine mammal and determines that the injury or death is not associated with or related to the activities authorized in the IHA (*e.g.*, previously wounded animal, carcass with moderate to advanced decomposition, or scavenger damage), Ocean Wind would report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS, and the NMFS GARFO Regional Stranding Coordinator, within 24 hours of the discovery. Ocean Wind would provide photographs or video footage (if available) or other documentation of the stranded animal sighting to NMFS. Ocean Wind can continue its operations under such a case.

- Within 90 days after completion of the marine site characterization survey activities, a technical report will be provided to NMFS and BOEM that fully documents the methods and monitoring protocols, summarizes the data recorded during monitoring, estimates the number of marine mammals that may have been taken during survey activities, and provides an interpretation of the results and effectiveness of all monitoring tasks. Any recommendations made by NMFS must be addressed in the final report prior to acceptance by NMFS.

- In addition to the Applicant's reporting requirements outlined above, Ocean Wind will provide an assessment report of the effectiveness of the various mitigation techniques, *i.e.* visual observations during day and night, compared to the PAM detections/operations. This will be submitted as a draft to NMFS and BOEM 30 days after the completion of the HRG and geotechnical surveys and as a final version 60 days after completion of the surveys.

Negligible Impact Analysis and Determinations

NMFS has defined negligible impact as an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival. A negligible impact finding is based on the lack of likely adverse effects on annual rates of recruitment or survival (*i.e.*, population-level effects). An estimate of the number of takes, alone, is not enough information on which to base an impact determination. In addition to considering the authorized number of marine mammals that might be "taken" through harassment, NMFS considers other factors, such as the likely nature of any responses (*e.g.*, intensity, duration), the context of any responses (*e.g.*, critical reproductive time or location, migration, etc.), as well as effects on habitat, the status of the affected stocks, and the likely effectiveness of the mitigation. Consistent with the 1989 preamble for NMFS' implementing regulations (54 FR 40338; September 29, 1989), the impacts from other past and ongoing anthropogenic activities are incorporated into these analyses via their impacts on the environmental baseline (*e.g.*, as reflected in the regulatory status of the species, population size and growth rate where known, ongoing sources of human-caused mortality, or ambient noise levels).

As discussed in the *Potential Effects* section, permanent threshold shift, masking, non-auditory physical effects, and vessel strike are not expected to occur. Further, once an area has been surveyed, it is not likely that it will be surveyed again, thereby reducing the likelihood of repeated impacts within the project area.

Potential impacts to marine mammal habitat were discussed previously in this document (see the *Potential Effects of the Specified Activity on Marine Mammals and their Habitat* section). Marine mammal habitat may be impacted by elevated sound levels and some sediment disturbance, but these impacts would be temporary. Feeding behavior is not likely to be significantly impacted, as marine mammals appear to be less likely to exhibit behavioral reactions or avoidance responses while engaged in feeding activities (Richardson *et al.*, 1995). Prey species are mobile and are broadly distributed throughout the Lease Area; therefore, marine mammals that may be temporarily displaced during survey activities are expected to be able to resume foraging once they have moved away from areas with disturbing levels of underwater noise. Because of the temporary nature of the disturbance, the availability of similar habitat and resources in the surrounding area, and the lack of important or unique marine mammal habitat, the impacts to marine mammals and the food sources that they utilize are not expected to cause significant or long-term consequences for individual marine mammals or their populations. Furthermore, there are no rookeries or mating grounds known to be biologically important to marine mammals within the proposed project area. A biologically important feeding area for North Atlantic right whale encompasses the Lease Area (LaBrecque *et al.*, 2015); however, there is no temporal overlap between the biologically important area (BIA) (effective March-April; November-December) and the proposed survey activities (May-June; October). There is one ESA-listed species for which takes are proposed for the fin whale. There are currently

insufficient data to determine population trends for fin whale (Waring *et al.*, 2015); however, we are proposing to authorize a single take for this species, therefore, we do not expect population-level impacts. There is no designated critical habitat for any ESA-listed marine mammals within the Lease Area, and none of the stocks for non-listed species proposed to be taken are considered “depleted” or “strategic” by NMFS under the MMPA.

The proposed mitigation measures are expected to reduce the number and/or severity of takes by (1) giving animals the opportunity to move away from the sound source before HRG survey equipment reaches full energy and (2) reducing the intensity of exposure within a certain distance by reducing the DP thruster power. Additional vessel strike avoidance requirements will further mitigate potential impacts to marine mammals during vessel transit to and within the Study Area.

Ocean Wind did not request, and NMFS is not proposing, take of marine mammals by injury, serious injury, or mortality. NMFS expects that most takes would be in the form of short-term Level B behavioral harassment in the form of brief startling reaction and/or temporary avoidance of the area or decreased foraging (if such activity were occurring)—reactions that are considered to be of low severity and with no lasting biological consequences (*e.g.*, Southall *et al.*, 2007). This is largely due to the short time scale of the proposed activities, the low source levels and intermittent nature of many of the technologies proposed to be used, as well as the required mitigation.

NMFS concludes that exposures to marine mammal species and stocks due to Ocean Wind’s HRG and geotechnical survey activities would result in only short-term (temporary and short in duration) and relatively infrequent effects to individuals exposed and not of the type or severity that would be expected to be additive for the very small portion of the stocks and species

likely to be exposed. Given the duration and intensity of the activities (including the mitigation) NMFS does not anticipate the proposed take estimates to impact annual rates of recruitment or survival. Animals may temporarily avoid the immediate area, but are not expected to permanently abandon the area. Major shifts in habitat use, distribution, or foraging success, are not expected.

Based on the analysis contained herein of the likely effects of the specified activity on marine mammals and their habitat, and taking into consideration the implementation of the proposed monitoring and mitigation measures, NMFS preliminarily finds that the total marine mammal take from the proposed activity will have a negligible impact on all affected marine mammal species or stocks.

Small Numbers

As noted above, only small numbers of incidental take may be authorized under Section 101(a)(5)(D) of the MMPA for specified activities other than military readiness activities. The MMPA does not define small numbers and so, in practice, NMFS compares the number of individuals taken to the most appropriate estimation of the relevant species or stock size in our determination of whether an authorization is limited to small numbers of marine mammals.

Table 9. Summary of potential marine mammal takes and percentage of stocks affected.

Species	Requested Take Authorization (No.)	Stock abundance estimate	Percentage of Stock Potentially Affected
Fin Whale (<i>Balaenoptera physalus</i>)	5	1,618	0.31
Bottlenose Dolphin (<i>Tursiops truncatus</i>)	286	77,532	0.368
Short beaked common Dolphin (<i>Delphinus delphis</i>)	32	70,184	0.045
Harbor Porpoise (<i>Phocoena phocoena</i>)	4*	79,883	0.005
Harbor Seal ¹ (<i>Phoca vitulina</i>)	1	75,834	0.001

*Modeled take of this species was increased to account for average group size.

The requested takes proposed to be authorized for the HRG and geotechnical surveys represent 0.31 percent of the WNA stock of fin whale, 0.045 percent of the WNA stock of short-beaked common dolphin, 0.368 percent of the Western north Atlantic, offshore stock of bottlenose dolphin, 0.005 percent of the Gulf of Maine/Bay of Fundy stock of harbor porpoise, and 0.001 percent of the WNA stock of harbor seal (Tables 9). These take estimates represent the percentage of each species or stock that could be taken by Level B behavioral harassment and are extremely small numbers (less than 1 percent) relative to the affected species or stock sizes.

Based on the analysis contained herein of the proposed activity (including the proposed mitigation and monitoring measures) and the anticipated take of marine mammals, NMFS preliminarily finds that small numbers of marine mammals will be taken relative to the population size of the affected species or stocks.

Unmitigable Adverse Impact Analysis and Determination

There are no relevant subsistence uses of the affected marine mammal stocks or species implicated by this action. Therefore, NMFS has determined that the total taking of affected species or stocks would not have an unmitigable adverse impact on the availability of such species or stocks for taking for subsistence purposes.

Endangered Species Act

Issuance of an MMPA authorization requires compliance with the ESA. Within the project area, fin, humpback, and North Atlantic right whale are listed as endangered under the ESA. Under section 7 of the ESA, BOEM consulted with NMFS on commercial wind lease issuance and site assessment activities on the Atlantic Outer Continental Shelf in Massachusetts, Rhode Island, New York and New Jersey Wind Energy Areas. NOAA's GARFO issued a Biological Opinion concluding that these activities may adversely affect but are not likely to

jeopardize the continued existence of fin whale, humpback whale, or North Atlantic right whale.

The Biological Opinion can be found online at

http://www.nmfs.noaa.gov/pr/permits/incidental/energy_other.htm. NMFS is also consulting internally on the issuance of an IHA under section 101(a)(5)(D) of the MMPA for this activity.

Following issuance of the Ocean Wind's IHA, the Biological Opinion may be amended to include an incidental take exemption for these marine mammal species, as appropriate.

National Environmental Policy Act (NEPA)

NMFS is preparing an Environmental Assessment (EA) in accordance with the National Environmental Policy Act (NEPA) and will consider comments submitted in response to this notice as part of that process. The EA will be posted at

http://www.nmfs.noaa.gov/pr/permits/incidental/energy_other.htm once it is finalized.

Proposed Authorization

As a result of these preliminary determinations, NMFS proposes to issue an IHA to Ocean Wind for conducting HRG survey activities and use of DP vessel thrusters during geotechnical survey activities from June 2017 through May 2018, provided the previously mentioned mitigation, monitoring, and reporting requirements are incorporated. This section contains a draft of the IHA itself. The wording contained in this section is proposed for inclusion in the IHA (if issued).

Ocean Wind, LLC (Ocean Wind) is hereby authorized under section 101(a)(5)(D) of the Marine Mammal Protection Act (16 U.S.C. 1371(a)(5)(D)) and 50 CFR 216.107, to harass marine mammals incidental to high-resolution geophysical (HRG) and geotechnical survey investigations associated with marine site characterization activities off the coast of New Jersey

in the area of the Commercial Lease of Submerged Lands for Renewable Energy Development on the Outer Continental Shelf (OCS-A 0498) (the Lease Area).

1. This Authorization is valid from June 1, 2017 through May 31, 2018.
2. This Authorization is valid only for HRG and geotechnical survey investigations associated with marine site characterization activities, as described in the Incidental Harassment Authorization (IHA) application.
3. The holder of this authorization (Holder) is hereby authorized to take, by Level B harassment only, 32 short-beaked common dolphins (*Delphinus delphis*), 286 bottlenose dolphin (*Tursiops truncatus*), 4 harbor porpoise (*Phocoena phocoena*), 5 fin whale (*Balaenoptera physalus*), and 1 harbor seal (*Phoca vitulina*) incidental to HRG survey activities and dynamic positioning (DP) vessel thruster use during geotechnical activities.
4. The taking of any marine mammal in a manner prohibited under this IHA must be reported immediately to NMFS' Greater Atlantic Regional Fisheries Office (GARFO).
5. The Holder or designees must notify NMFS GARFO and Office of Protected Resources (OPR) at least 24 hours prior to the seasonal commencement of the specified activity.
6. The holder of this Authorization must notify the Chief of the Permits and Conservation Division, Office of Protected Resources, or her designee at least 24 hours prior to the start of survey activities (unless constrained by the date of issuance of this Authorization in which case notification shall be made as soon as possible) at 301-427-8401 or to laura.mccue@noaa.gov.
7. Mitigation Requirements

The Holder is required to abide by the following mitigation conditions listed in 7(a)-(f). Failure to comply with these conditions may result in the modification, suspension, or revocation of this IHA.

(a) *Marine Mammal Exclusion Zones*: Protected species observers (PSOs) shall monitor the following zones for the presence of marine mammals:

- A 200-m exclusion zone during HRG surveys is in operation.
- A 500-m monitoring zone during the use of DP thrusters during geotechnical survey.
- At all times, the vessel operator shall maintain a separation distance of 500 m from any sighted North Atlantic right whale as stipulated in the *Vessel Strike Avoidance* procedures described below.

Visual monitoring of the established exclusion zone(s) shall be performed by qualified and NMFS-approved protected species observers (PSOs). An observer team comprising a minimum of four NMFS-approved PSOs and two certified Passive Acoustic Monitoring (PAM) operators, operating in shifts, shall be stationed aboard either the survey vessel or a dedicated PSO-vessel. PSOs shall be equipped with binoculars and have the ability to estimate distances to marine mammals located in proximity to the vessel and/or exclusion zone using range finders.

Reticulated binoculars will also be available to PSOs for use as appropriate based on conditions and visibility to support the siting and monitoring of marine species. Digital single-lens reflex camera equipment shall be used to record sightings and verify species identification. During night operations, PAM (see *Passive Acoustic Monitoring* requirements below) and night-vision equipment in combination with infrared video monitoring shall be used. The PSOs shall begin observation of the exclusion zone(s) at least 60 minutes prior to ramp-up of HRG survey

equipment. Use of noise-producing equipment shall not begin until the exclusion zone is clear of all marine mammals for at least 60 minutes. If a marine mammal is seen approaching or entering the 200-m exclusion zones during the HRG survey, or the 500-m monitoring zone during DP thrusters use, the vessel operator shall adhere to the shutdown/powerdown procedures described below to minimize noise impacts on the animals.

(b) *Ramp-Up*: A ramp-up procedure shall be used for HRG survey equipment capable of adjusting energy levels at the start or re-start of HRG survey activities. The ramp-up procedure shall not be initiated during daytime, night time, or periods of inclement weather if the exclusion zone cannot be adequately monitored by the PSOs using the appropriate visual technology (*e.g.*, reticulated binoculars, night vision equipment) and/or PAM for a 60-minute period. A ramp-up shall begin with the power of the smallest acoustic HRG equipment at its lowest practical power output appropriate for the survey. The power shall then be gradually turned up and other acoustic sources added such that the source level would increase in steps not exceeding 6 dB per 5-minute period. If a marine mammal is sighted within the HRG survey exclusion zone prior to or during the ramp-up, activities shall be delayed until the animal(s) has moved outside the monitoring zone and no marine mammals are sighted for a period of 60 minutes.

(c) *Shutdown and Powerdown*

HRG Survey - The exclusion zone(s) around the noise-producing activities HRG survey equipment will be monitored, as previously described, by PSOs and at night by PAM operators for the presence of marine mammals before, during, and after any noise-producing activity. The vessel operator must comply immediately with any call for shutdown by the Lead PSO. If a non-delphinoid (*i.e.*, mysticetes and sperm whales) cetacean is detected at or within the established exclusion zone (200-m exclusion zone during HRG surveys), an immediate shutdown of the

HRG survey equipment is required. Subsequent restart of the electromechanical survey equipment must use the ramp-up procedures described above and may only occur following clearance of the exclusion zone for 60 minutes. If a delphinoid cetacean or pinniped is detected at or within the exclusion zone, the HRG survey equipment must be powered down to the lowest power output that is technically feasible. Subsequent power up of the survey equipment must use the ramp-up procedures described above and may occur after (1) the exclusion zone is clear of a delphinoid cetacean and/or pinniped for 60 minutes or (2) a determination by the PSO after a minimum of 10 minutes of observation that the delphinoid cetacean or pinniped is approaching the vessel or towed equipment at a speed and vector that indicates voluntary approach to bow-ride or chase towed equipment. If the HRG sound source shuts down for reasons other than encroachment into the exclusion zone by a marine mammal including but not limited to a mechanical or electronic failure, resulting in the cessation of sound source for a period greater than 20 minutes, a restart for the HRG survey equipment is required using the full ramp-up procedures and clearance of the exclusion zone of all cetaceans and pinnipeds for 60 minutes. If the pause is less than 20 minutes, the equipment may be restarted as soon as practicable at its operational level as long as visual surveys were continued diligently throughout the silent period and the exclusion zone remained clear of cetaceans and pinnipeds. If the visual surveys were not continued diligently during the pause of 20 minutes or less, a restart of the HRG survey equipment is required using the full ramp-up procedures and clearance of the exclusion zone for all cetaceans and pinnipeds for 60 minutes.

Geotechnical Survey (DP Thrusters) - During geotechnical survey activities if marine mammals enter or approach the established 120 dB isopleth monitoring zone, the Holder shall reduce DP thruster to the maximum extent possible, except under circumstances when reducing

DP thruster use would compromise safety (both human health and environmental) and/or the integrity of the equipment. After decreasing thruster energy, PSOs shall continue to monitor marine mammal behavior and determine if the animal(s) is moving towards or away from the established monitoring zone. If the animal(s) continues to move towards the sound source then DP thruster use shall remain at the reduced level. Normal use shall resume when PSOs report that the marine mammals have moved away from and remained clear of the monitoring zone for a minimum of 60 minutes since the last sighting.

(d) *Vessel Strike Avoidance*: The Holder shall ensure that vessel operators and crew maintain a vigilant watch for cetaceans and pinnipeds and slow down or stop their vessels to avoid striking these protected species. Survey vessel crew members responsible for navigation duties shall receive site-specific training on marine mammal sighting/reporting and vessel strike avoidance measures. Vessel strike avoidance measures shall include the following, except under extraordinary circumstances when complying with these requirements would put the safety of the vessel or crew at risk:

- All vessel operators shall comply with 10 knot (<18.5 km per hour (km/h)) speed restrictions in any Dynamic Management Area (DMA). In addition, all vessels operating from November 1 through July 31 shall operate at speeds of 10 knots (<18.5 km/h) or less.
- All survey vessels shall maintain a separation distance of 500 m or greater from any sighted North Atlantic right whale.
- If underway, vessels must steer a course away from any sighted North Atlantic right whale at 10 knots (<18.5 km/h) or less until the 500 m minimum separation distance has been established. If a North Atlantic right whale is sighted in a vessel's

path, or within 100 m to an underway vessel, the underway vessel must reduce speed and shift the engine to neutral. Engines shall not be engaged until the North Atlantic right whale has moved outside of the vessel's path and beyond 100 m. If stationary, the vessel must not engage engines until the North Atlantic right whale has moved beyond 100 m.

- All vessels shall maintain a separation distance of 100 m or greater from any sighted non-delphinoid (*i.e.*, mysticetes and sperm whales) cetacean. If sighted, the vessel underway must reduce speed and shift the engine to neutral, and must not engage the engines until the non-delphinoid cetacean has moved outside of the vessel's path and beyond 100 m. If a survey vessel is stationary, the vessel shall not engage engines until the non-delphinoid cetacean has moved out of the vessel's path and beyond 100 m.
- All vessels shall maintain a separation distance of 50 m or greater from any sighted delphinoid cetacean. Any vessel underway shall remain parallel to a sighted delphinoid cetacean's course whenever possible, and avoid excessive speed or abrupt changes in direction. Any vessel underway shall reduce vessel speed to 10 knots or less when pods (including mother/calf pairs) or large assemblages of delphinoid cetaceans are observed. Vessels may not adjust course and speed until the delphinoid cetaceans have moved beyond 50 m and/or abeam of the underway vessel.
- All vessels shall maintain a separation distance of 50 m (164 ft) or greater from any sighted pinniped.

(e) *Seasonal Operating Requirements:* Between watch shifts members of the monitoring team shall consult the NMFS North Atlantic right whale reporting systems for the presence of North Atlantic right whales throughout survey operations. The proposed survey activities shall occur outside of the seasonal management area (SMA) located off the coast of New Jersey and Delaware and outside of the seasonal mandatory speed restriction period for this SMA (November 1 through April 30). Throughout all survey operations, the Holder shall monitor the NMFS North Atlantic right whale reporting systems for the establishment of a DMA. If NMFS should establish a DMA in the Lease Area under survey, within 24 hours of the establishment of the DMA the Holder shall work with NMFS to shut down and/or alter the survey activities to avoid the DMA.

(f) *Passive Acoustic Monitoring:* To support 24-hour survey operations, the Holder shall include PAM as part of the project monitoring during the geophysical survey during nighttime operations, or as needed during periods when visual observations may be impaired. In addition, PAM systems shall be employed during daylight hours to support system calibration and PSO and PAM team coordination, as well as in support of efforts to evaluate the effectiveness of the various mitigation techniques (*i.e.*, visual observations during day and night, compared to the PAM detections/operations).

The PAM system shall consist of an array of hydrophones with both broadband (sampling mid-range frequencies of 2 kHz to 200 kHz) and at least one low-frequency hydrophone (sampling range frequencies of 75 Hz to 30 kHz). The PAM operator(s) shall monitor the hydrophone signals in real time both aurally (using headphones) and visually (via the monitor screen displays). PAM operators shall communicate detections/vocalizations to the Lead PSO on duty who shall ensure the implementation of the appropriate mitigation measure.

8. Monitoring Requirements

The Holder is required to abide by the following monitoring conditions listed in 8(a)-(b). Failure to comply with these conditions may result in the modification, suspension, or revocation of this IHA.

(a) *Visual Monitoring* – Protected species observers (refer to the PSO qualifications and requirements for *Marine Mammal Exclusion Zones* above) shall visually monitor the established Level B harassment zones (200-m radius during HRG surveys; 500-m radius during DP thruster use). The observers shall be stationed on the highest available vantage point on the associated operating platform. PSOs shall estimate distance to marine mammals visually, using laser range finders or by using reticulated binoculars during daylight hours. During night operations, PSOs shall use night-vision binoculars and infrared technology. Data on all PSO observations will be recorded based on standard PSO collection requirements. This will include dates and locations of survey operations; time of observation, location and weather; details of the sightings (*e.g.*, species, age classification (if known), numbers, behavior); and details of any observed “taking” (behavioral disturbances or injury/mortality). In addition, prior to initiation of survey work, all crew members will undergo environmental training, a component of which will focus on the procedures for sighting and protection of marine mammals

(b) *Acoustic Field Verification* – Field verification of the exclusion/monitoring zones shall be conducted to determine whether the proposed zones correspond accurately to the relevant isopleths and are adequate to minimize impacts to marine mammals. The Holder shall conduct field verification of the exclusion/monitoring zone (the 160 dB isopleth) for HRG survey equipment and the monitoring/powerdown zone (the 120 dB isopleth) for DP thruster use for all equipment operating below 200 kHz. The Holder shall take acoustic measurements at a

minimum of two reference locations and in a manner that is sufficient to establish source level (peak at 1 meter) and distance to the 160 dB isopleth (the Level B harassment zones for HRG surveys) and 120 dB isopleth (the Level B harassment zone) for DP thruster use. Sound measurements shall be taken at the reference locations at two depths (*i.e.*, a depth at mid-water and a depth at approximately 1 meter (3.28 ft) above the seafloor). The Holder may use the results from its field-verification efforts to request modification of the exclusion/monitoring zones for the HRG or geotechnical surveys. Any new exclusion/monitoring zone radius proposed by the Holder shall be based on the most conservative measurements (*i.e.*, the largest safety zone configuration) of the target Level A or Level B harassment acoustic threshold zones. The modified zone shall be used for all subsequent use of field-verified equipment. The Holder shall obtain approval from NMFS and BOEM of any new exclusion/monitoring zone before it may be implemented and the IHA shall be modified accordingly.

9. Reporting Requirements

The Holder shall provide the following reports as necessary during survey activities:

(a) The Holder shall contact NMFS (301-427-8401) and BOEM (703-787-1300) within 24 hours of the commencement of survey activities and again within 24 hours of the completion of the activity.

(b) Any observed significant behavioral reactions (*e.g.*, animals departing the area) or injury or mortality to any marine mammals shall be reported to NMFS and BOEM within 24 hours of observation. Dead or injured protected species shall be reported to the NMFS GARFO Stranding Hotline (800-900-3622) within 24 hours of sighting, regardless of whether the injury is caused by a vessel. In addition, if the injury or death was caused by a collision with a project related vessel, the Holder shall ensure that NMFS and BOEM are notified of the strike

within 24 hours. The Holder shall use the form included as Appendix A to Addendum C of the Lease to report the sighting or incident. If the Holder is responsible for the injury or death, the vessel must assist with any salvage effort as requested by NMFS.

Additional reporting requirements for injured or dead animals are described below
(*Notification of Injured or Dead Marine Mammals*).

(c) *Notification of Injured or Dead Marine Mammals*

(i) In the unanticipated event that the specified HRG and geotechnical survey activities lead to an injury of a marine mammal (Level A harassment) or mortality (*e.g.*, ship-strike, gear interaction, and/or entanglement), the Holder shall immediately cease the specified activities and report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources, 301-427-8401, and the NOAA GARFO Stranding Coordinator, 978-281-9300. The report shall include the following information:

- Time, date, and location (latitude/longitude) of the incident;
- Name and type of vessel involved;
- Vessel's speed during and leading up to the incident;
- Description of the incident;
- Status of all sound source use in the 24 hours preceding the incident;
- Water depth;
- Environmental conditions (*e.g.*, wind speed and direction, Beaufort sea state, cloud cover, and visibility);
- Description of all marine mammal observations in the 24 hours preceding the incident;
- Species identification or description of the animal(s) involved;

- Fate of the animal(s); and
- Photographs or video footage of the animal(s) (if equipment is available).

Activities shall not resume until NMFS is able to review the circumstances of the event.

NMFS would work with the Holder to minimize reoccurrence of such an event in the future. The Holder shall not resume activities until notified by NMFS.

(ii) In the event that the Holder discovers an injured or dead marine mammal and determines that the cause of the injury or death is unknown and the death is relatively recent (*i.e.*, in less than a moderate state of decomposition), the Holder shall immediately report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources, 301-427-8401, and the GARFO Stranding Coordinator, 978-281-9300. The report shall include the same information identified in the paragraph above. Activities would be able to continue while NMFS reviews the circumstances of the incident. NMFS would work with the Holder to determine if modifications in the activities are appropriate.

(iii) In the event that the Holder discovers an injured or dead marine mammal and determines that the injury or death is not associated with or related to the activities authorized in the IHA (*e.g.*, previously wounded animal, carcass with moderate to advanced decomposition, or scavenger damage), the Holder shall report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS, 301-427-8401, and the NMFS GARFO Regional Stranding Coordinator, 978-281-9300, within 24 hours of the discovery. The Holder shall provide photographs or video footage (if available) or other documentation of the stranded animal sighting.

(d) Within 90 days after completion of the marine site characterization survey activities, a technical report shall be provided to NMFS and BOEM that fully documents the methods and

monitoring protocols, summarizes the data recorded during monitoring, estimates the number of marine mammals that may have been taken during survey activities, and provides an interpretation of the results and effectiveness of all monitoring tasks. Any recommendations made by NMFS shall be addressed in the final report prior to acceptance by NMFS.

(e) In addition to the Holder's reporting requirements outlined above, the Holder shall provide an assessment report of the effectiveness of the various mitigation techniques, *i.e.* visual observations during day and night, compared to the PAM detections/operations. This shall be submitted as a draft to NMFS and BOEM 30 days after the completion of the HRG and geotechnical surveys and as a final version 60 days after completion of the surveys.

10. This Authorization may be modified, suspended, or withdrawn if the Holder fails to abide by the conditions prescribed herein or if NMFS determines the authorized taking is having more than a negligible impact on the species or stock of affected marine mammals.

11. A copy of this Authorization and the Incidental Take Statement must be in the possession of each vessel operator taking marine mammals under the authority of this Incidental Harassment Authorization.

12. The Holder is required to comply with the Terms and Conditions of the Incidental Take Statement corresponding to NMFS' Biological Opinion.

Request for Public Comments

We request comment on our analyses, the draft authorization, and any other aspect of this

Notice of Proposed IHA for the proposed HRG and geotechnical survey investigation. Please include with your comments any supporting data or literature citations to help inform our final decision on the request for MMPA authorization.

Dated: April 27, 2017.

Donna S. Wieting,

Director, Office of Protected Resources,

National Marine Fisheries Service.

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